CLOSURE INVESTIGATION REPORT

PREPARED FOR:

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JUNE 1, 2000

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Project Number: 98-478-03

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Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

Project No. 98-478-02
June 1, 2000

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1.0 INTRODUCTION

1.1 GENERAL

The Refined Metals Corporation (RMC) facility was the location of secondary lead smelting operations from 1968 through 1995. The location of the site is shown on Figure 1-1. RMC was involved in the reclamation of lead from used automotive and industrial batteries and other lead-bearing materials. The site ceased normal operations on December 31, 1995.

During its operational life, the facility handled hazardous materials or hazardous wastes under the Resource Conservation and Recovery Act (RCRA). These primarily consisted of lead-bearing materials that were processed for lead recovery. In accordance with the requirements of RCRA, the facility completed and submitted a RCRA permit application. On November 19, 1980 the facility was granted approval to operate two hazardous waste management units under Interim Status: 1) indoor waste piles; and 2) outdoor waste piles. Facility documents also identify a lined lagoon as a RCRA permitted unit; however, it does not appear to have been included on the Facility Part A permit until after 1991. The lagoon was, and still is, used to collect facility storm water runoff. See Figure 1-2 for the location of the RCRA Solid Waste Management Units (SWMUs).

At this time the site is idle except for the waste water treatment system which remains in operation to collect and treat storm water runoff from the lined lagoon and other site areas. Former indoor and outdoor waste piles have been removed.

1.2 PURPOSE

On July 14, 1998 Refined Metals Corporation entered into a Consent Decree with the United States Environmental Protection Agency (USEPA) and the Indiana Department of Environmental Management (IDEM), Civil Action No. IP902077C. The technical objectives of the Consent Decree are as follows:

1. Effectuate closure of waste piles and surface impoundment by submitting a closure plan and post-closure plan, if necessary, and then to implement the plan(s) as approved;

2. Perform a RCRA Facility Investigation (RFI) to evaluate and determine the full nature and extent of releases and collect information necessary to support a Corrective Measures Study, or Interim Measures;

3. Perform Interim/Stabilization Measures to abate threats to human health and the environment;

4. Perform a Corrective Measures Study to develop and evaluate alternatives and to recommend a final corrective measure(s); and,

5. Perform Corrective Measures.

Pursuant to Section VI, Paragraph 37 of the Consent Decree (Compliance Requirements for Closure), Advanced GeoServices Corp. (AGC) prepared a Closure Plan on behalf of RMC for the three on-site SWMUs. The Closure Plan was prepared in accordance with Indiana Department of Environmental Management (IDEM) Hazardous Waste Management Unit Closure Guidance (Waste-0013-ND) and Risk Assessment Addendum. The results of closure plan implementation as summarized in this Closure Investigation Report, help further characterize the three SWMUs to implement closure of the facility.

1.3 ORGANIZATION

This Closure Investigation Report contains a description of the sampling performed for the SWMUs, the results of the laboratory analysis of those samples, and the recommendations for the closure of the RMC facility. This document is organized as follows:

- Section 1.0 - General Introduction provided above;
- Section 2.0 - Facility Background, including its operating history and regulatory status;
- Section 3.0 - Description of Solid Waste Management Units to be closed;
- Section 4.0 - Sampling Methods and Procedures used to characterize the SWMUs;
- Section 5.0 - Results of the sampling performed on the SWMUs;
- Section 6.0 - Conclusions and Recommendations

2.0 FACILITY BACKGROUND

2.1 FACILITY LOCATION

The RMC facility is located at 3700 South Arlington Avenue in Beech Grove, Marion County, Indiana, approximately four miles south-southeast of downtown Indianapolis. The Site occupies approximately 24 acres, of which approximately 10 acres represented the active manufacturing area (including paved areas and buildings). The remaining 14 acres includes grass and wooded areas. The configuration of the Site is triangular, bounded by Arlington Avenue (oriented in a north to south direction representing the hypotenuse), Big Four Road (along the base), and the common property line with a natural gas company (Citizens Gas) forming the third side. The northwest end of the triangle is truncated by a railroad right-of-way (Figure 1-2).

The Site is relatively flat with less than 10 feet of total relief. Natural site drainage is toward the north and east. The former manufacturing area is characterized by nearly 80,000 square feet (sf) of structures consisting of the battery breaker, a waste water treatment plant, a filter press, material storage areas, a blast furnace, a dust furnace, a metals refining area, warehouse and offices. In addition, there are four baghouses, a vehicle maintenance structure, and five storm water pump houses.

The ground surface surrounding the buildings is currently paved (primarily with concrete). Older facility photographs indicate that areas northwest and northeast of the main facility structure were unpaved except for a concrete driveway, which encircled the facility. The paved surface areas are sloped to drain toward catch basins situated around the Site. The catch basins in-turn flow to the storm water pump houses that convey collected storm water to the waste water treatment plant for immediate processing (small storm events) or to a 750,000 gallon stormwater and fire control lagoon where it is stored until it can be processed (large storm events). The lagoon was originally lined with concrete. During 1988, the lagoon was cleaned out and the concrete was covered with a geomembrane liner.

2.2 OWNERSHIP HISTORY

The Site was reportedly undeveloped woodlands until 1968. In 1968, the property was developed as a secondary lead smelter by National Lead. National Lead operated the facility from 1968 through 1980, when it was sold to Exide Corporation. In 1985, the Site was purchased from Exide Corporation by RMC. RMC continued to operate the facility until the cessation of operations on December 31, 1995. From April 14, 1995 through December 31, 1995, operations were reduced to enriching and casting lead ingots from off-specification lead products. Since 1996, no production has taken place at the facility except for operation of the waste water treatment facility, which is still used to treat storm water runoff from the former manufacturing areas.

2.3 OPERATIONAL HISTORY

2.3.1 Smelting

The facility was constructed as a secondary lead smelter to recycle lead-acid batteries and other lead-bearing wastes. Auto batteries constituted 90 percent of the materials recycled, and the remainder was waste material from battery manufacturers and other lead scrap.

Prior to 1984, battery crushing was performed off-site at other commercial facilities. In 1984, the battery breaker was constructed on-site. During post-1984 operations, the batteries were temporarily stored in trailers or on pallets in a paved storage yard. The batteries were then fed into the battery crusher where the tops of the batteries were sawed off and the sulfuric acid was collected in a sump and transferred into a stainless steel tank that drained to the wastewater treatment system. The battery casings and their contents were tumbled and crushed. Lead plates and other lead parts were separated and transported to waste piles to be later fed into the furnace. The battery casings were shredded and separated into plastic and ebonite in a flotation tank. The plastic was blown into a trailer for sale to an off-site recycler. Ebonite casings were placed in a separate waste pile and then fed into the blast furnace as a supplemental fuel.

Prior to 1984, storage piles were located outdoors with minimal spill and runoff control. The majority of storm water runoff from the piles and other work areas flowed and/or was pumped to the storm water lagoon where it was allowed to evaporate. However, when the lagoon was full, it overflowed to a drainage ditch that flowed off-site toward the east. A small portion of the drainage from the active manufacturing area flowed uncontrolled toward the wooded area to the north, and then along an intermittent stream to the north (Figure 1-2). During 1984, the material storage building was constructed and the waste piles were moved inside. Reportedly, material was occasionally stored outside after 1984 when the material storage building was full.

One blast furnace and one dust furnace were used at the facility. During operation, the blast furnace used coke and oxygen-enriched air for heating. Liquid oxygen was stored in a 10,000-gallon tank located north of the blast furnace building. Scrap iron was added to the blast furnace to remove sulfur. During the smelting process, molten lead would form at the bottom of the furnace, and the slag would float to the top. The slag was poured into ingots and solidified before being sent off-site for disposal. The dust furnace used natural gas and oxygen-enriched air to melt baghouse dust, which was then fed into the blast furnace.

2.3.2 Refining

Molten lead from the blast furnace was tapped from the bottom of the furnace to kettles in the adjacent refining and casting area. In the kettles, the molten lead was tested to determine its quality. Antimony and tin were either added or removed to create the required lead type and quality. Removal of antimony and tin was performed by adding sodium hydroxide or through other methods of oxidation. If the lead contained excess copper it was removed through the addition of red phosphorus. The excess antimony, tin, copper and other impurities formed as a dross on top of the molten lead and was removed through skimming. The dross was returned to the blast furnace. The refined lead was typically cast into 60-pound bars that were cooled, extracted and stacked for shipment off-site.

The refining kettles were situated with their tops approximately at floor level in the refining and casting building. The bottom of the kettles extended below grade into a sub-floor area. The kettles were heated by natural gas burners located in the sub-floor area.

2.3.3 Wastewater Treatment

With the installation of the battery crusher in 1984, waste sulfuric acid, and acidic and lead-bearing wastewater was actively collected for treatment through a batch neutralization process. During 1988, the Site was also re-graded and storm water drainage modified to allow the collection and treatment of all storm water runoff from the active manufacturing areas. Wastewater effluent is discharged to the Municipal Sanitary Sewer system which conveys the wastewater for treatment at the City of Indianapolis POTW.

2.3.4 Storage Tanks

Reportedly, underground storage tanks (USTs) were never used at the Site. Three above ground storage tanks (ASTs) - two 10,000-gallon ASTs and one 20,000-gallon AST - were used to store diesel fuel for company trucks. The tanks were reportedly cleaned out in 1985 and have since been out of service. The three tanks are enclosed by a spill containment wall. The tanks were reportedly constructed in 1968 and the containment was built some time prior to 1980, although the date that the containment was added could not be determined. The three ASTs are located at the northeast end of the former manufacturing area as shown on Figure 1-2. A 500-gallon AST and a 750-gallon AST are presently used for diesel fuel and gasoline, respectively, to fuel on-site vehicles. The 750-gallon gasoline tank is enclosed within a spill containment wall and pad located near the office building. The 500-gallon diesel tank has no secondary containment. Propane, which is used to power forklifts, is stored in a 2,000-gallon tank. The diesel tank and the propane tank are located side by side near the waste water treatment building.

A leak in a valve of one of the now out-of-service diesel tanks occurred around 1983, resulting in a spill of unknown volume outside of the containment wall. A portion of the spill flowed along the drainage ditch located north of the refining area. The contaminated soil was excavated and the tanks were emptied.

Although documentation of the spill and subsequent response action is not available, the soil clean-up was reportedly conducted under state supervision.

2.4 REGULATORY HISTORY

2.4.1 RCRA

As stated above, following the promulgation of RCRA, the facility submitted a Part A RCRA permit application. On November 19, 1980 the facility was granted Interim Status as a hazardous waste treatment, storage and disposal facility. The RCRA Subtitle C units included indoor and outdoor waste piles (used to store batteries and lead-bearing wastes), and after 1991 the 750,000 gallon concrete lined lagoon was also identified as a RCRA subtitle C unit. A Part B application was submitted during the mid-1980s, although full RCRA permitted status was never granted. The EPA maintains that interim stauts was lost on November 8, 1985 as a result of RMC's alleged failure to comply with Section 3005(e)(2) of RCRA, 42 U.S.C. 6925(e)(2); RMC did not agree with this allegation.

RMC submitted a revised Part A application on October 26, 1988 requesting an increase in the storage volume for spent batteries from 200 cubic yards (cy) to 400 cy. The request was granted on September 20, 1989. A subsequent revised Part A application was submitted to IDEM on December 7, 1990 for increasing the storage volume of spent batteries from 400 cy to 500 cy. IDEM denied the increase. RMC filed for a stay and was granted interim status to store 400 cy of spent batteries, however, IDEM approved the revised Part A application on June 3, 1991 with the provision that it did not grant interim status under RCRA. The Part B application was not resubmitted. In 1994, the facility withdrew its Part A and Part B permit applications.

The following enforcement actions were identified for the facility:

- Notice of Violation April 13, 1982;
- Notice of Violation July 30, 1982;
- Complaint Order (N-283) December 13, 1985;
- Notice of Violation (V-442) February 16, 1987; and,
- Letter of Warning March 26, 1987.

The IDEM issued a draft Agreed Order addressing deficiencies in 1989. Deficiencies identified included:

- Spills had occurred in the baghouse area (the nature of the spillage was not identified).

- Scrap had been stored in waste piles without run-on, runoff, or wind dispersal control, and wastewater from dust control had been allowed to overflow from the drainage system to a ditch that flowed off-site.

- Waste slag had not been analyzed to determine if it was hazardous.

- The inspection and documentation program for security devices, spills, and equipment was deficient.

- The emergency response, contingency plan, and training programs were deficient.

RMC responded to the draft Order in October 1989, and requested modifications to indicate that many of the deficiencies identified had been corrected. IDEM issued a revised Agreed Order to RMC on September 4, 1990. The revised Order contained several of the items to which RMC protested in the original draft Order. RMC did not sign the Order, but completed the following actions to comply with the draft Order:

- The furnace slag was analyzed and determined to be non-hazardous. Subsequent analysis for metals using the toxicity characteristic leaching procedure (TCLP) for leachability determined that the material contained hazardous concentrations of lead.

- The parking areas and building floors were covered with a 6-inch thick concrete pad. Storm water runoff from potentially contaminated areas was contained and was pumped to the wastewater treatment system via three 10,000-gallon sumps that were constructed in 1988. In 1989, the concrete-lined storm water pond was pumped out and the sediment was removed and processed in the blast furnace. After cleaning, the concrete surface in the pond was coated with a sealant and covered with a heavy vinyl plastic geomembrane liner.

RMC believed that all of the deficiencies identified in the draft Order were corrected. However, IDEM did not comment on the documents related to the improvements. Negotiations with IDEM concerning the Order were suspended when the USEPA filed a complaint in Federal Court against the RMC facility on November 21, 1990. The complaint requested the court to order RMC to cease its operations as a hazardous waste treatment, storage, and disposal facility, to submit a closure plan, prepare and implement a plan to investigate the nature and extent of hazardous waste constituents released from the facility and the effects on groundwater, to prepare a plan for remediation of contamination in and around the facility, and to pay a fine for each violation. The complaint indicates that the USEPA had issued a "Determination of Release of Hazardous Waste into the *Environment from a RCRA Interim Status Facility*" on or about *May 5, 1989*. Negotiations ensued between RMC and the USEPA concerning the deficiencies. A draft Consent Decree was also being negotiated between RMC and the USEPA which was ultimately lodged on July 14, 1998 (Civil

Action #IP902077C). This Closure Investigation Report is being submitted under the requirements of the Consent Decree.

2.4.2 CERCLA

A site inspection was performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. In 1985, a preliminary assessment was performed under CERCLA. No further action was planned under CERCLA at that time.

2.4.3 State and Local Permits

2.4.3.1 **Waste Water Discharge Permit**

A City of Indianapolis Permit to Discharge Waste Water to the Municipal Sewer System (Permit #334103) was issued on May 1, 1993. On January 6, 1994, RMC was informed that they were no longer required to sample for pH, arsenic, lead, zinc, and antimony, and a monthly self-monitoring report was no longer required under their permit to discharge waste water.

2.4.3.2 **Air Permits**

The Beech Grove facility originally had ten certificates of operation Nos. 08025 through 08034 for its seven refinery kettles and three baghouses (M-1 through M-3). The permits were issued by the Air Pollution Control Section of the City of Indianapolis Department of Public Works.

RMC received approval for a fugitive dust control program from the City on July 15, 1991. Installation Permit (#910036-01) was issued by the City of Indianapolis on September 11, 1991 for a total enclosure building to house the blast and dust furnaces, both of which were vented to a new baghouse, M-4. The seven refinery kettles were also re-directed to vented through baghouse M-4. The allowable emissions of lead for M-4 were 0.30 pounds per hour (lb/hr).

An Installation Permit (950036-01) was issued on May 22, 1995 to install a natural gas-fired after burner and scrubber to baghouse M-1. The allowable emissions established in the installation permit were as follows:

Total suspended particles - 0.003 gr/dscf, or 2.8 ton/yr

Lead - 0.91 lb/hr, or 3.99 ton/yr

Sulfate - 64.8 lb/hr, 283.82 ton/yr, or 10.8 lb sulfate/ton of material discharged.

The Indianapolis Air Pollution Control Section granted an Operating Permit on August 26, 1994 for fuel combustion - gas, oil, blast furnace, secondary lead smelter, dust furnace, blast furnace, metallurical baghouse (M-1), blast furnace sanitary baghouse (M-2), sanitary baghouse (M-4), and refinery sanitary baghouse (M-3).

The City of Indianapolis granted an Operating Permit, facility number 0036 on January 12, 1995 for the following:

0036-01	M-1	Allowable: Total suspended particulate - 0.003 gr/dscf, 2.8 ton/yr Lead - 0.91 lb/hr, 3.99 ton/yr Sulfate 64.8 lb/hr
0036-02	M-2	Allowable: Total suspended particulate - 0.0005 gr/dscf, <1 ton/yr Lead - 0.015 lb/hr, 0.66 ton/yr
0036-03	M-3	Allowable: Total suspended particulate - 0.03 gr/dscf Lead - 0.015 lb/hr, 0.66 ton/yr
0036-04	M-4	Allowable: Total suspended particulate - 0.03 gr/dscf Lead - 0.3 lb/hr, 1.31 ton/yr

On January 10, 1995, RMC entered into an Agreed Order with IDEM to address Clean Air Act violations.

A revised Construction Permit (950036-01) for M-1 afterburner and scrubber was granted on May 23, 1995.

2.5 NATURE AND EXTENT OF CONTAMINATION

2.5.1 Behavior Of Lead

A number of the materials formerly used at the facility have toxic characteristics, however, the principal material of concern is lead. Lead is a common metal, and can be found at an average concentration in excess of 30 ppm in natural soils and 1-10 ug/l in surface water. Most lead salts are fairly insoluble in water, however the solubility depends on the pH, with solubility increasing in more acidic conditions. Movement of lead in soils depends on its adsorption, chelation with organic matter, and the precipitation of the less soluble salts. In general, lead reacts with soil anions or clays to form insoluble complexes, inhibiting its mobility. Lead can be ingested or absorbed by inhalation. Poisoning from acute exposure to lead is uncommon. The primary toxic effects from chronic exposure are on the blood and the nervous system.

2.5.2 Discussion Of Source Areas

Facility inspection reports identified poor housekeeping, storage of materials on unpaved surfaces, spillage in a baghouse, and runoff/runon control for the outdoor waste piles as situations which could aid migration from the paved Site area.

Based on the documented operating history and an understanding of the character of lead mobility and transport, the most significant potential sources of contamination at the facility during its operating history were erosion and transport of lead-bearing solids from outdoor waste piles and other areas by stormwater runoff (prior to re-engineering of site drainage to contain all runoff from the manufacturing area); fugitive dust emissions from traffic and production areas, unpaved outdoor waste pile areas (north and west of the material storage building) and stack emissions. Based on original facility grading, transport and deposition of lead-bearing sediment from the facility to areas northeast and east of the Battery Breaker building could have occurred prior to containment of site stormwater runoff. The lined stormwater lagoon and the channels that received lagoon overflow represent potential source areas. In addition, those areas that were either unpaved or not covered by a building within the active manufacturing areas could represent an area where lead contaminated sediment or materials could have accumulated and were subsequently covered with pavement or a structure. The fugitive dust and stack emissions could have resulted in the deposition of lead on the ground surface within and beyond the manufacturing area.

During the preparation of the Closure Plan, AGC performed a review of RMC files to identify previous sampling activities. The file review indicated that previous sampling of environmental media at the facility was limited to an investigation of soils and building interiors performed by ENTACT, Inc. during April 1996 and quarterly groundwater sampling performed by RMC since June 1991. The data provided by these samples proved to be insufficient for the characterizing required for the closure of the three SWMUs. Information and results for the soil samples collected by EPA, as referenced in the Consent Decree, could not be located.

3.0 SOLID WASTE MANAGEMENT UNITS TO BE CLOSED

3.1 OUTDOOR WASTE PILES

Reportedly, the main outdoor waste pile areas were primarily located to the west and north of the Material Storage Building (MSB). Additional areas designated as outdoor waste piles were located on the southeast and northeast side of the MSB, along the south and west side of the Warehouse, and the west corner of the parking lot. The general locations of the former outdoor waste piles are shown on Figure 1-2; however the exact dimensions of the former outdoor waste piles are unknown. The total area of the outdoor waste piles is estimated to be approximately 2 acres. The process waste code for the former outdoor waste piles was SO3.

The outdoor waste piles consisted of 90% lead plates and parts from automobile batteries, and 10% waste material from battery manufacturers and other lead scrap. The USEPA hazardous waste number for the lead was D008. The material was staged outside and later fed into the blast furnace. The exact capacity, maximum inventory, and total volume of the unit over the life of the facility could not be quantified based on a file review performed by AGC; however, the most recent Part A applications indicated the maximum design capacity for spent batteries was 15,000 cubic yards. At the present time the outdoor waste piles have been removed.

A limited amount of broken plastic battery casings were found in an unpaved area along the northwest side of the property. This area has a poor vegetative cover and drainage from the area is poorly defined and may, during extreme rainfall events, be a source of runoff to the Citizens Gas Company on the adjacent property. This area on the Citizens Gas Company Property was sampled during the RCRA Facility Investigation (RFI); the results are provided in the RFI report.

3.2 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

The indoor waste piles were located in the MSB (see Figure 1-2). The MSB is approximately 180 feet by 180 feet with a concrete floor of varying thickness. Conflicting information indicates the MSB was constructed during or prior to 1984. The process waste code for the material inside the MSB was SO6. The walls and roof are primarily sheet metal. Holes in the walls were sealed with a polyurethane-type foam to reduce potential airborne releases from the waste piles. The concrete floors are heavily corroded in some areas, and no floor drains were visible during site visits by AGC. Three operating entrances to the building exist: 1.) vehicle entrance in the north corner that connects the MSB directly to the Battery Breaker Building; 2.) vehicle entrance from the outside on the west side of the building; and 3.) internal doorway on the south side that connects the MSB directly to the Blast Furnace Building. In addition, three sealed vehicle entrances were noted on the east and south exterior walls of the MSB that served as entrances to the loading dock from the MSB.

The indoor waste piles consisted of 90% lead plates and parts from automobile batteries, and 10% waste material from battery manufacturers and other lead scrap. The USEPA hazardous waste number for the lead was D008. The material was stored in different bins within the building until they were later fed into the blast furnace. The exact capacity, maximum inventory, and total volume of the unit over the life of the facility could not be determined; however, the most recent Part A applications indicated the maximum design capacity for spent batteries was 4,600 cubic yards. The indoor waste piles have been removed. Dust and dirt (presumably former furnace feed material) remains on the floor with several inches of accumulation in some areas.

3.3 LINED LAGOON

The lined lagoon is located southeast of the main manufacturing buildings. The lagoon is approximately 0.4 acre and has a capacity of 600,000 gallons. The process code for the lagoon is SO4.

Prior to 1984, the lagoon received runoff from the outdoor waste piles. Stormwater was allowed to evaporate and when the lagoon was full, allowed to overflow. The lagoon's original overflow channel was located on the southern side. The overflow channel discharged to a swale which ran along the northern side of the entrance driveway and to the stormwater swale along Arlington Avenue. In 1984, the existing waste water treatment plant was constructed. During this period, a concrete sump with a level-controlled pump was installed in the lagoon to prevent overflowing. Water in the lagoon was periodically pumped to the wastewater treatment plant for treatment and subsequently discharged to the POTW.

The lined stormwater lagoon was reportedly last cleaned out during 1996. RMC continues to operate the lagoon for the purpose of managing stormwater runoff which is ultimately treated through the waste water treatment system. Sediment has accumulated since the last cleaning and cattails are growing in the bottom. An RMC representative at the Site reported that the lagoon is managed to prevent overtopping and the subsequent discharge to off-site surface drainage features.

4.0 SAMPLING METHODS AND PROCEDURES

4.1 INTRODUCTION

This section discusses the sampling performed for this Closure Plan. The Closure Plan activities described in this Report were conducted concurrently with RCRA Facility Investigation (RFI) Activities. The purpose of the Closure Investigation activities is to determine the vertical extent of impact to soils in the SWMUs, (as defined by the Region 9 PRG for lead in soil and by the Tier 1 Default Remediation value for the other metals analyzed) from former facility operation, to better characterize these units prior to closure. As such, the scope of the investigation contained in this report is limited to characterizing soil, dust and sediment within and beneath the limits of the areas subject to closure. Extent of impact outside the limits of the RCRA permitted units is covered by the RFI. Field activities were conducted by AGC and laboratory analysis was performed by TriMatrix Laboratories Inc. of Grand Rapids, MI.

4.2 BACKGROUND SOIL SAMPLING

Background soil levels are defined as the mean of four sample concentrations for each soil horizon plus two standard deviations. Samples were collected from areas believed to be unaffected by past hazardous waste management unit operations or manufacturing operations at the facility. The background sampling locations are shown on Figure 4-1 and are referred to with the prefix BSB. One composite sample was collected from the A and the B soil horizon, which varied in depth, at each location using a decontaminated hand auger. The A horizon was defined as different from the B horizon by having more organic material content. Each soil horizon was identified in the field by an AGC representative experienced in soil sampling and characterization. The composite sample was generated by using the entire sample retrieved from the boring for each horizon. The sample was placed into a mixing bowl and thoroughly homogenized. Following homogenization, a representative sample was collected from the bowl and placed in a laboratory-supplied sample jar. Each sample was immediately placed on ice for shipment to TriMatrix to be analyzed for total arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver (8 RCRA metals), antimony, and pH.

Prior to sampling at each location, all downhole and non-disposable homogenizing equipment was decontaminated using the following procedures:

- Wash equipment thoroughly with a non-phosphate detergent (Alconox) and water using a brush to remove any particulate matter or surface film;
- Rinse equipment with distilled water;
- Rinse with diluted 10 % nitric acid;
- Triple rinse with distilled water;
- Air dry equipment; and,
- Wrap equipment in a clean plastic sleeve or in aluminum foil if not used immediately.

The background soil sampling was performed on August 26, 1999.

4.3 OUTDOOR WASTE PILES

Soil samples were collected on the site to more fully determine the extent of site-related constituents in soil. The total area of the outdoor waste piles is 2 acres. Due to the discontinuous and irregular shape of the outdoor waste piles, a total of six sub-areas were created (number 1 through 6 on Figure 4-1). A 10 ft. grid interval was created for each sub-area. In accordance with the IDEM's Hazardous Waste Management Unit Closure Guidance (Waste-0013-ND) Risk Addendum, the cube root of the total number of grid nodes was used to calculate the minimum number of random sampling locations for each sub-area. A random numbers table was subsequently used to select the grid nodes to be sampled. In addition, one directed soil sampling location was selected on each side of the Battery Breaker Building. Figure 4-1 shows these soil sample locations designated as CSB-1 through CSB-32. (CSB-26 was performed within the MSB immediately adjacent to the outdoor stockpile east of the MSB because the proposal location was inaccessible to equipment capable of penetrating the former loading dock. The Schneider Corporation of Indianapolis, Indiana, a licensed surveyor in the state of Indiana, located these sample points, and the data was presented in the state-plane coordinate system.

Samples were collected from the following intervals: 0-3 inches, 6-9 inches, 12-15 inches, 24-28 inches, 36-39 inches, 48-51 inches, and 60-63 inches below ground surface (bgs) using a Geoprobe™ at each location. In areas covered with pavement, the Geoprobe™ was used to penetrate and remove the pavement and then to collect the soil samples from beneath the pavement. The samples were removed from the Geoprobes™ disposable acetate sleeve using a disposable scoop and placed directly into the laboratory-supplied sample jars. The samples were immediately placed on ice for shipment to TriMatrix. All samples from 0 to 2 ft. were analyzed for the eight RCRA metals, antimony, and pH (SW 846 6016 and 7470). All samples below 2 ft. were archived to be analyzed, if deemed necessary, based upon the results of the shallow soil samples. Prior to sampling at each location and for each four foot interval, a new acetate sleeve was placed in the Geoprobe™ for collection of the sample. All downhole equipment was decontaminated as required by the QAPP.

4.4 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

4.4.1 Floor Dust Sampling

Floor dust sampling was conducted at three locations on the floor within the MSB to characterize the floor dust material. Sampling locations were selected in the field in areas with sufficient dust and are indicated on Figure 4-1 as CFD-1 through CFD-3. Samples were collected using dedicated, disposable, plastic scoops. Dust samples were placed into laboratory-supplied jars and placed on ice for shipment. The samples were submitted to TriMatrix to be analyzed for total lead and cadmium (SW 846 6016).

4.4.2 Subfloor Soil Sampling

A random grid and directed soil sampling program was implemented for the indoor waste pile areas. The random sampling was designated for the entire unit using the same generation process described in Section 4.3 for the outdoor waste piles. The indoor waste piles (i.e., MSB) are located within an area of approximately 0.7 acres. The number of required random sample locations was calculated to be 10. The sampling locations are indicated on Figure 4-1 as samples CSB-33 through CSB-42 and were surveyed by The Schneider Corporation.

In addition, directed sampling was performed at three locations where the concrete floor slab appeared to have deteriorated as a result of former use and could have created a potential pathway for migration to groundwater. These sample locations are indicated on Figure 4-1 as CSB-49 through CSB-51.

The floor slabs were penetrated using the Geoprobe™ rig and subfloor soils were collected in four foot runs using a Geoprobe™. Samples were collected from the sample run at the following intervals: 0-3 inches, 6-9 inches, 12-15 inches, 24-28 inches, 36-39 inches, 48-51 inches and 60-63 inches bgs using a geoprobe. The samples were removed from the Geoprobes™ disposable acetate sleeve using a plastic disposable scoop. Samples were placed directly into the laboratory-supplied sample jars, and placed on ice for shipment to TriMatrix. All samples from 0 to 2 ft. were analyzed for the eight RCRA metals, antimony, and pH (SW 846 6016 and 7470). Samples below 2 ft. were archived to be analyzed, if deemed necessary, based on the results of the shallow soil samples. Prior to sampling at each location and every four feet interval a new acetate sleeve was placed in the Geoprobe™ for each soil collection run and all downhole equipment was decontaminated using the process described in Section 4.3.

4.5 LINED LAGOON

4.5.1 Introduction

Previous sampling efforts did not address the lagoon. The lagoon has a known history of receiving runoff from the outdoor waste piles and ground surfaces. Therefore, this investigation focused on collecting sediment samples from within the lined lagoon. Sampling efforts surrounding the lined lagoon involved collecting sediment from the bottom of the lagoon on top of the liner. Sampling within the lagoon also involved collecting soil samples from directly beneath the concrete as per request of IDEM.

4.5.2 Sediment

Random grid sampling techniques were used to select the sampling locations. Figure 4-1 shows the sediment sample locations indicated as CSED-1 through CSED-4. The locations were surveyed by The Schneider Corporation.

Four sediment samples were collected from the bottom of the lagoon at a depth of 0-3 inches. Samples were collected using a disposable scoop so as to not jeopardize the integrity of the liner. Samples were placed directly into the laboratory-supplied sample jars and placed on ice for shipment to TriMatrix . All samples were analyzed for the eight RCRA metals, antimony, and pH (SW 846 6016 and 7470).

4.5.3 Soil

Five separate sampling locations for the soil beneath the concrete/geomembrane liner of the lagoon were established in the Closure Plan using the random generation process described in Section 4.3. The locations are represented as CSB-43 through CSB-47 on Figure 4-1. Approximately 80 percent of the surface of the lagoon was densely covered by cattails and their root network, which served to retain water. Due to the inability to completely remove all of the water from the lagoon in areas heavily vegetated by cattails, it was not possible to sample at one location in the center of the lagoon.

Samples were collected by neatly cutting the geomembrane and then coring through the concrete. A hand driven Geoprobe™ was used to collect soil samples from the following intervals: 0-3 inches, 6-9 inches, 12-15 inches, 24-27 inches, 36-39 inches, 48-51 inches, and 60-63 inches below the concrete soil interface. An exception to this occurred at sample location CSB-47 where refusal was encountered at 40 inches below the concrete. A second unsuccessful attempt to sample below 40 inches was made adjacent to CSB-47.

The samples were removed from the Geoprobes™ disposable acetate sleeve using a disposable scoop. Samples were placed directly into the laboratory-supplied sample jars and placed on ice for shipment to TriMatrix. All samples from 0 to 2 ft. were analyzed for the eight RCRA metals, antimony, and pH (SW 846 6016 and 7470). Samples below 2 ft. were archived to be analyzed, if deemed necessary, based on the results of the shallower soil samples. Prior to sampling at each depth interval (hand driven Geoprobe™ samplers are shorter than typical Geoprobe™ samplers), a new acetate sleeve was placed in the Geoprobe™ for collection of the sample. All downhole equipment and non-dedicated sampling equipment were decontaminated using the process described in Section 4.3. The concrete and geomembrane liner was repaired following completion of the sampling.

4.6 GROUNDWATER SAMPLING

4.6.1 Introduction

Under 40 CFR Subpart F Section 265.90(c), RMC believes the requirement for groundwater monitoring can be waived. As presented in the Closure Plan Section 10.2.4, groundwater data has been collected on a fairly consistent quarterly basis from June 1991 through March 1997.

The groundwater data collected at the site has indicated, in general, metals concentrations in filtered groundwater samples have been well below the corresponding Maximum Contaminant Levels (MCLs) or action levels of the National Primary Drinking Water Regulations (40 CFR 141) and 40 CFR 264.94 (a) (2) for inorganics.

4.6.2 Well Construction

All monitoring wells constructed as part of the RFI and Closure Plan field activities consist of a 4-inch ID, flush-threaded, Schedule 40 PVC riser with a 10-foot length of factory-slotted 0.010-inch PVC well screen. A sand pack was placed to 2 feet above the top of the monitoring well screen with No. 5 sand. A minimum 2-foot thick Bentonite seal was placed on top of the sand pack. The remaining annulus of each borehole was tremie-grouted to the surface using a 95% Portland Cement/5% Bentonite grout.

All monitoring wells installed as part of the RFI and Closure Plan activities were completed with a 6-inch square steel protective casing with a locking cap. The protective casing extends from an approximate depth of 3 feet bgs to approximately 2 feet above ground. A neat cement seal was placed around the protective casing to a depth of three feet bgs. A 2 x 2 foot square well pad was installed so that the surface slopes away from the well.

Borings that were not completed as wells were abandoned by grouting the borehole to the surface using a 95% Portland Cement/5% Bentonite grout.

4.6.3 Well Development

Monitoring wells were developed using the surge-block and pump method. Monitoring wells were first surged using a plunger-type surge block assembly. This provides the necessary turbulence in and near the well screen to remove fine-grained material and to properly develop the well. The wells were then purged and developed using a submersible pump (except MW-6S which was developed using a decontaminated bailer because of low water production). When the development water in each well was relatively sediment free, exhibited a satisfactory clarity and yield, and pH and specific conductance readings had stabilized as measured in the field, development was ceased.

To confirm that the lined lagoon is not negatively impacting groundwater, the RFI groundwater investigation results are being included in this Closure Investigation Report. In addition to the existing five monitoring wells, one shallow and one deep groundwater well was installed adjacent and down-gradient of the lined lagoon. A potentiometric surface map was not previously available to determine the direction of groundwater flow on the site. Following a survey of the elevations of the existing wells by The Schneider Corporation, water levels were measured, and a potentiometric surface map was constructed in the field to determine the downgradient side of the lined lagoon. The shallow well was installed on the downgradient side of the lagoon as detailed in the following section. Two comprehensive groundwater sampling events of the five existing shallow wells, the new shallow well and two new deep wells (installed in accordance with the RFI Work Plan) were performed by AGC on behalf of RMC. The first event occurred on September 21, 1999 through

September 23, 1999. The second groundwater sampling event was conducted on December 14 and 15, 1999. The specific sampling procedures are presented in Sections 4.6.3 and 4.6.4.

4.6.4 Well Evacuation

Groundwater samples were collected from the five original shallow monitoring wells, the sixth shallow well and the two deep wells installed as part of the implementation of the RFI using the low-flow technique. An initial inspection of the condition of each well was made and recorded in the field book. The depth to water in each monitoring well was determined and the purge volume calculated. This provided the sampling team with an estimate of when stabilization of purging parameters would occurr.

The wells were purged using a stainless steel low-flow bladder pump placed at the midpoint of the screen in each well. The USEPA recommends purging and sampling groundwater monitoring wells at low rates (200 to 300 milliliters per minute (mls/min)). Purging at low rates (micropurging), as compared to past traditional methods, helps minimize re-development of the well and mobilization of additional particulate and colloidal matter. Low-flow sampling reduces well turbidity, and minimizes potential changes in chemical concentrations resulting from mixing of formation water with stagnant water in the well casing. The wells were purged at a flow rate ranging from 100 to 300 milliliters per minute mls/min, depending on the yield of the well. A flow-through cell was used to measure pH, temperature, conductivity, redox potential, and dissolved oxygen prior to contact with oxygen at 3 to 5 minute intervals during purging. Turbidity was also measured at the same time interval. The wells were purged until the field parameters stabilized to within 10% over three readings and pH readings differed by less than 0.1 unit.

For shallow well MW-6, insufficient volume was available to purge using low-flow techniques and the well purged dry. Due to insufficient volume, a disposable Teflon bailer was used to purge and sample the well. Since this method elevates the turbidity of groundwater, the sample was filtered for metal analysis.

Purge water was contained in 55-gallon drums and was stored until analytical results of groundwater samples were evaluated. Based on analytical results the purge water from those wells was discharged to the ground surface or discharged to the lined lagoon for subsequent treatment by the on-site wastewater treatment plant. Purge water was not allowed to flow off-site.

4.6.5 Sample Withdrawal

Once the field parameters had stabilized, the flow rate was reduced to 100 mls/min. for collecting VOC samples and 100 to 300 mls/min. for the remaining parameters. Samples were then collected directly from the pump discharge line into laboratory-supplied sample bottles containing the necessary preservatives. The samples were packed on ice and shipped to TriMatrix Laboratories Inc. for analysis of eight RCRA metals and antimony. Additionally, as agreed with the USEPA for the RFI activities, 1,1,1-trichloroethane, tetrachloroethene, benzene, toluene, and ethylbenzene were analyzed in groundwater samples collected from the six shallow wells during the first sampling event. These parameters were analyzed because mineral spirits were reportedly used at the facility and a parts cleaning unit was maintained by Safety Kleen. As agreed upon with EPA under the RFI process, No VOC analysis of groundwater was performed during the second event because no VOCs were detected in first round of groundwater sampling.

MW-6S did not produce a sufficient volume of water to sample with the low-flow pump, so a disposable Teflon bailer was used to collect the sample. The dedicated disposable bailer was lowered slowly into the screened interval to collect the sample with minimal agitation to the water. Samples were then collected in laboratory-supplied sample bottles containing the necessary preservatives. These samples were packed on ice and shipped to TriMatrix Laboratories Inc. for analysis of eight RCRA metals and antimony (SW 846 6016).

As provided for in the RFI Work Plan for wells that purge dry prior to sampling, the samples collected from MW-6S were analyzed for both total and dissolved metals. Samples for dissolved metals analyses were field filtered through a dedicated, disposable Nalgene 0.45 m membrane filter immediately after collection and prior to preservation. The sample was decanted into the dedicated, Nalgene disposable filtration unit and filtered under vacuum pressure created by a hand-held pump. Additionally, an unfiltered sample from MW-6S was analyzed for 1,1,1-trichloroethane, tetrachloroethene, benzene, toluene, and ethylbenzene (USEPA 8260).

4.7 SUPPLEMENTAL SURVEY

The Schneider Corporation performed a survey of all soil and sediment sampling locations between August 25, 1999 and August 31, 1999 for the purpose of accurately representing the sampling locations. In addition, the existing monitoring wells were surveyed on August 6, 1999 and the newly installed monitoring wells were surveyed between August 25, 1999 and August 31, 1999.

4.8 QUALITY ASSURANCE

The Quality Assurance Project Plan (QAPP) developed as part of the RFI Work Plan was used for the RMC Closure Plan. The procedures outlined in the QAPP for sample collection, custody procedures and shipment of samples to the laboratory were followed throughout the Closure Investigation. Data validation reports are provided appendices to this report. Because of the volume of the actual laboratory data packages they have not been included in the report, but are available upon request.

5.0 RESULTS

5.1 INTRODUCTION

Closure Investigation activities included the analysis of the eight RCRA metals, plus antimony. The results for all nine parameters are included in Table 5-2. The following discussion presents a brief summary for all parameters, but, because lead is the dominant constituent associated with former site operations, emphasis has been placed on the discussion of lead. Where other constituents are encountered at noteworthy concentrations, most typically they are in the presence of significantly elevated lead.

5.2 BACKGROUND SOIL SAMPLES

Consistent with the requirements of the Closure Investigation Work Plan, background soil borings were conducted in remote areas of the site and corresponding samples were analyzed for the eight RCRA metals. Results of the background investigation are summarized on Table 5-1. Background concentrations were calculated for each horizon as the mean plus two standard deviations. The results of the background calculations are summarized on Table 5-1A. Antimony, Arsenic and Lead background concentrations are all greater than their corresponding Tier 1 Default Remediation Value which have been used for the preliminary screening purposes. Utilizing lead as an indicator of the representativeness of the background soil boring, it is apparent that BSB-2 and BSB-4 have notably elevated concentrations. As such, the usefulness of these results may be limited.

5.3 OUTDOOR WASTE PILES

The validated analytical results of the soil samples collected from the outdoor waste piles and analyzed for 8 RCRA metals, antimony and pH are included in Appendix B and are summarized in Table 5-2. All samples with an "A" suffix indicate the 0-3 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 8.0 J mg/kg at CSB-22 to 467,000 mg/kg at CSB-12. Figure 5-1 illustrates lead concentrations detected at this depth.

All samples with a "B" suffix indicate the 6-9 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 7.7 J mg/kg at CSB-22 to 460,000 mg/kg at CSB-4. Figure 5-2 illustrates lead concentrations detected at this depth.

All samples with a "C" suffix indicate the 12-15 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 9.8 mg/kg at CSB-22 to 180,000 mg/kg at CSB-2. Figure 5-3 illustrates lead concentrations detected at this depth.

Sample analysis below the depth of 24 inches was required when the results of the overlying samples were greater than the EPA Region 9 PRG for lead and/or when the results of the remaining metals were over the IDEM Tier 1 residential default remediation value. During the execution of work, the industrial PRG for lead, 1,000 mg/kg, was inadvertently utilized for screening instead of the residential standard of 400 mg/kg. When this was identified and an attempt was made to have the subsequent samples analyzed, the lab had already discarded the deeper samples. As a result, five of the outdoor waste pile borings (CSB-1, 10, 11, 26, and 32) (CSB-26 was drilled immediately inside of the MSB because the outdoor waste pile area immediately east of the MSB was inaccessible to equipment that could penetrate the concrete loading dock) terminate at depths with soil lead concentrations between 400 and 1,000 mg/kg. In addition, one sample location (CSB-2) was missed by the lab in the request for re-analysis and had a total lead concentrations at the 12-15 inch depth of 180,000 mg/kg. The corresponding concentrations at CSB-2 for antimony, arsenic and selenium were all above the Tier 1 residential default remediation value.

Because of the naturally high background concentrations of arsenic in regional soils, results of most samples were above the Tier 1 residential default remediation value for arsenic. However, when compared to the calculated background concentration, only CSB-2 did not define the vertical limit of arsenic above background in the outdoor waste pile samples. Seven of the sample locations did not define the vertical limit of antimony when compared to the Tier 1 default remediation value (CSB-1, 2, 8, 19, 11, 12, and 30); however, only CSB-2 and CSB-30 were above the background antimony concentration. Chromium concentrations at CSB-28 were not defined to their vertical limit using the Tier 1 value for one of the duplicate samples taken at the 12-15 inch depth, although the result is qualified as J "estimated". Only the selenium results in CSB-2 failed to define the vertical limits of selenium over the Tier 1 residential default remediation value.

5.4 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

5.4.1 Floor Dust Sampling

The validated analytical results of the floor dust samples collected from the Materials Storage Building (MSB) and analyzed for total lead and cadmium are included in Appendix A. CFD-1 contained 497,000 mg/kg of lead. CFD-2 contained 342,000 mg/kg of lead. CFD-3 contained 707,000 mg/kg of lead. Cadmium results were 436 mg/kg, 357 mg/kg and 547 mg/kg for CFD-1, 2 and 3 respectively. Floor dust samples results are provided in Appendix A.

5.4.2 Subfloor Soil Sampling

The validated analytical results of the soil samples collected from beneath the floor of the Materials Storage Building and analyzed for eight RCRA metals, antimony and pH are included in Appendix B and are summarized in Table 5-2. All samples with an "A" suffix indicate the 0-3 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 11 mg/kg at CSB-42 to 94,500 mg/kg at CSB-34. Figure 5-1 illustrates lead concentrations detected at this depth.

All samples with a "B" suffix indicate the 6-9 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 8.9 mg/kg at CSB-41 to 10,300 mg/kg at CSB-51. Figure 5-2 illustrates lead concentrations detected at this depth.

All samples with a "C" suffix indicate the 12-15 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 8.8 mg/kg at CSB-41 to 5,680 mg/kg at CSB-51. Figures 5-3 illustrates lead concentrations detected at this depth.

Similar to the outdoor waste piles, sample analysis below the depth of 24 inches was required when the results of the overlying samples were greater than the EPA Region 9 PRG for lead and/or when the results of the remaining metals were over the IDEM Tier 1 residential default remediation value. All of the indoor waste pile borings except CSB-35 and 51 defined the vertical concentration for lead to less than 400 mg/kg. Borings CSB-35 and 51 had deeper samples, to 51 inches and 63 inches respectively analyzed, but were still over the screening level for lead. When the deepest sample in CSB-35 was requested for analysis, the lab had already discarded the samples. All of the samples in CSB-51 had been analyzed.

Because of the naturally high background concentrations of arsenic in regional soils, results of most samples were above the Tier 1 default remediation value for arsenic. When compared to the calculated background concentration, all of the borings reached concentrations below background. Two of the sample locations did not define the vertical limit of antimony when compared to the Tier 1 residential default remediation value (CSB-35 and 51). Both CSB-35 and 51 were also above the calculated background values for antimony. Chromium concentrations at CSB-38 were not defined to their vertical limit using the Tier 1 residential default remediation value or calculated background.

5.5 LINED LAGOON

5.5.1 Sediment

The validated analytical results of the sediment samples collected from within the lagoon and analyzed for eight RCRA metals, antimony and pH are included in Appendix B and are summarized in Table 5-2. Four sediment samples from the bottom of the lagoon were collected at a depth of 0-3 inches. Lead concentrations in these samples ranged from 7,390 mg/kg to 161,000 mg/kg.

5.5.2 Soil

The validated analytical results of the soil samples collected from beneath the lagoon liner and analyzed for eight RCRA metals, antimony and pH are included in Appendix B. All samples with an "A" suffix indicate the 0-3 inches bgs depth interval; concentrations of lead at this depth range from 12 mg/kg at CSB-46 to 58 mg/kg at CSB-47. Figure 5-1 illustrates lead concentrations detected at this depth.

All samples with a "B" suffix indicate the 6-9 inches bgs depth interval; concentrations of lead at this depth range from 11 mg/kg at CSB-47 to 106 mg/kg at CSB-43. Figure 5-2 illustrates lead concentrations detected at this depth.

All samples with a "C" suffix indicate the 12-15 inches bgs depth interval; concentrations of lead at this depth range from non-detect at 9.9 mg/kg at CSB-45 to 24 mg/kg at CSB-43. Figures 5-3 illustrates lead concentrations detected at this depth.

5.6 GROUNDWATER QUALITY

5.6.1 First Quarterly Sampling Event

The analytical results and Validation Report for the first quarterly groundwater sampling are presented in Appendix C and are summarized in Table 5-3. Due to equipment blank contamination the detection limit for lead was raised to 55 ug/l (5 times the blank contamination) for all of the groundwater samples collected during the first quarter. Consequently, lead was not detected in any of the wells sampled during the first quarterly groundwater sampling. A potentiometric surface map is shown as Figure 5-4.

No other metals analyzed during the first round were detected above their corresponding Tier 1 Default Remediation Value for residential groundwater.

As agreed with the USEPA, 1,1,1-trichloroethane, tetrachloroethene, benzene, toluene, and ethylbenzene were analyzed in groundwater samples collected from the six shallow wells during the first sampling event. Analysis of the samples collected from the on-site wells for these compounds found no detectable concentrations of these compounds in any of the on-site wells. Accordingly, VOC sampling will not be conducted during future groundwater sampling events.

5.6.2 Second Quarterly Sampling Event

The analytical results and Validation Report for the second quarterly groundwater sampling event for the RFI are summarized in Appendix D and are summarized in Table 5-3. A potentiometric surface map is shown as Figure 5-5. Lead was detected at a concentration of 18 ug/l in MW-2S which is above the IDEM Tier 1 default remediation value for lead in residential groundwater and at a total concentration of 4.9 ug/l in MW-6S which is below (Table 5-4). No other metals analyzed during the second round were detected above their corresponding Tier 1 Default Remediation Value for residential groundwater. Samples were not analyzed for VOCs during the second quarterly sampling event, as they were not detected during the first sampling event.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 GENERAL

6.1.1 Site Stability

Based on the sample results and the observations made during the investigation, the SWMUs are currently within structures, beneath pavement, contained within the lagoon liner, or protected by a good grass cover. As a result, the SWMUs are considered stable and do not pose an immediate threat to human health or the environment and therefore do not require an emergency type action at the present time.

6.1.2 Constituents of Concern

Sampling activities included analysis of the eight RCRA metals plus antimony. Based on the sampling results, barium, mercury, selenium and silver can be eliminated from future consideration because they were consistently below the Tier 1 residential Default Remediation Value except in the presence of extremely high total lead concentrations (>25,000 mg/kg) which can be expected to be addressed as a result of a lead driven remedial action (the only exception was a single selenium sample result). Antimony, arsenic, cadmium, and chromium are retained as constituents of concern because of their regular occurrence over the Tier 1 residential Default Remediation Value and lead is retained because of its occurrence over the Region 9 PRG for lead in residential soil (400 mg/kg).

The next step proposed in the Closure Investigation Work Plan is to perform a site specific risk assessment in accordance with the requirements of the RISC Document Tier 3 guidelines. However, based on discussion with IDEM, the current review time for site specific risk assessments can be two or more years. As such, AGC recommends that a meeting be held with IDEM to discuss a process that would allow closure activities for the SWMUs to proceed in conjunction with the site wide corrective action being pursued as part of the RCRA closure process. This will include discussion of including antimony, arsenic, cadmium, and chromium in a risk assessment for those constituents in addition to the site specific lead exposure evaluation.

Because of the commercial industrial zoning of the site and surrounding areas, any future land should be considered non-residential for the purpose of risk assessment purposes. This can be ensured through appropriate site deed restrictions.

6.2 BACKGROUND SOIL

The representativeness of the background samples for lead and possibly antimony and arsenic may be questionable. Lead, antimony and arsenic were detected in background samples at levels above the Tier-1 residential value. Two of the four surficial background soil samples had lead concentrations above the residential screening value of 400 mg/kg, and one of the four sub-surface samples had lead concentrations greater than 400 mg/kg.

Arsenic was consistently above the Tier 1 residential default values being used for initial screening regardless of corresponding lead concentrations. This clearly suggests a high arsenic concentration in region soils. The background arsenic concentration observed in the four background borings was 19.0 mg/kg and 12.7 mg/kg for the surface and sub-surface horizons respectively. If future decisions about lead, arsenic and antimony will be dictated by background concentrations, additional background investigations will be necessary.

6.3 OUTDOOR WASTE PILES

The vertical limit of lead has been defined to less than the Region 9 PRG for industrial sites in all but one of the sample locations in the outdoor waste piles and below the Region 9 residential PRG in all but five sample locations. It is expected that the significantly elevated soil lead concentrations coincide with the depth of disturbance experienced during active use of the area and during grading activities performed as part of site paving work.

AGC recommends that five additional geoprobe borings be performed to a depth of 8 feet in the area north of the MSB to provide the additional information necessary to delineate the vertical limits of lead, antimony, cadmium, and arsenic. Specifically, the proposed borings should be located near the original borings CSB-2, CSB-8, CSB-11, CSB-13, and CSB-19 and all samples analyzed for total lead, antimony, cadmium, and arsenic.

6.4 INDOOR WASTE PILES

The floor of the MSB is significantly deteriorated in spots due to heavy equipment traffic and acid associated with the material handled in the building. Elevated lead in soil concentrations are generally associated with areas of floor deterioration. In areas of the MSB where the flooring is generally intact, lead results for the first soil horizon beneath the floor are consistent with surficial soils found throughout the site.

Lead concentrations in locations where the first soil horizon beneath the floor was elevated, quickly declined with depth. This allowed for the vertical delineation of the Region 9 PRG for industrial sites in all locations except two (CSB-35 and CSB-51).

AGC recommends that two additional geoprobe holes be performed within the MSB, one between CSB-35 and CSB-51 and a second in the area of CSB-38. Both geoprobes should be advanced to a depth of 12 feet. The samples collected should be analyzed for total lead, arsenic, antimony, and chromium.

6.5 MSB DUST SAMPLES

Dust in the MSB ranged from 0 to approximately 3 inches deep. Lead and cadmium concentrations in the dust samples, collected from the floor of the MSB, were very high. Future remediation activities in the MSB will likely include recycling of the dust at a secondary lead smelter. No other compounds were analyzed for the dust.

6.6 LAGOON SEDIMENTS

Sediment in the lagoon is approximately 0-6 inches thick. Elevated lead levels were detected in all of the sediment samples collected from the lagoon. The lagoon continues to be operational for containment of all stormwater on-site. Future remediation activities on-site will containerize and characterize for recycling through a secondary lead smelter or off-site disposal.

6.7 LAGOON SOILS

All the soil samples collected from beneath the lagoon were below the Region 9 PRP for residential soils and below the Tier 1 residential default values for antimony, barium, cadmium, chromium, lead, mercury, selenium and silver, except for a single sample which exceeded its corresponding default value for antimony (CSB-43B). Without exception, arsenic exceeded the Tier 1 residential default value.

The consistency of the results suggests that the water and sediments contained within the lined lagoon did not impact the underlying soils and therefore no further consideration of soils in this area are necessary. No further investigation is required of the lagoon soils.

6.8 GROUNDWATER

Investigation activities have confirmed that shallow groundwater beneath the site is flowing towards the northeast and southeast. The shallow zone occurs within the fine grained soil horizon and produces very little water, which in the case of MW-6S was so low it prevented the collection of samples with low flow sampling techniques. Groundwater quality within the shallow aquifer in general is below the Tier 1 residential default remediation value of 15 μg/L with the exception of total lead in MW-2S during the second sampling event. The relevance of the results for inorganics from the first sampling event is marginal because of equipment blank contamination which qualifies the MW-6S result as non-detect. As already recommended as part of the RFI investigation activities, two additional rounds of groundwater sampling should be performed for the shallow monitoring wells before final conclusions are drawn. Results from the two deep groundwater wells indicate that the deep groundwater has not been impacted, and therefore no further investigation of deep groundwater quality is necessary.

TABLES

BEECH GROVE
TABLE 5-1
Beech Grove Closure Investigation
Background Soil Samples

Sample Location	BSB-1A			BSB-1B			BSB-2A			BSB-2B			BSB-3A			BSB-3B			BSB-4A			BSB-4B		
Sample Description	dark brown silt with organics			dark brown/dark gray silt with no organics			brown silt with organics			brown sandy silt with no organics			dark brown silt with organics			dark brown/gray silty clay with no organics			dark brown/black silt with organics			brown sandy silt		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Parameter	Result	Q	DL	Result	Q	IDL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	IDL	Result	Q	DL
Antimony	4.3		1.0	1.8		1.0	26		1.0	2.5		1.0	4.0		1.0		U	1.0	44		1.0	34		1.0
Arsenic	5.5		1.0	5.9		1.0	13		1.0	5.1		1.0	7.0		1.0	5.4		1.0	16		1.0	12		1.0
Barium	66		1.0	87		1.0	53		1.0	57		1.0	98		1.0	95		1.0	279		1.0	276		1.0
Cadmium	0.77		0.50		U	0.50	3.5		0.50		U	0.50	1.3		0.50		U	0.50	3.3		0.50	2.2		0.5
Chromium	15		1.0	20		1.0	9.6		1.0	11		1.0	16		1.0	18		1.0	34		1.0	25		1.0
Lead	158		0.60	63		0.60	1200		0.60	74		0.60	257		0.60	20		0.60	1060		0.60	690		0.6
Mercury		U	0.10		U	0.10	0.11		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1
Selenium	0.98		0.50	0.92		0.50	0.97		0.50	0.53	J	0.50	1.3		0.50	1.0		0.50	0.76		0.50		U	0.5
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20	0.34		0.20	0.31		0.2

DL - Detection limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the detection limit.

TABLE 5-1A

"A" Horizon Background Calculation

	Mean	Std Dev.	Background Conc.
Antimony	19.6	16.7	53.0
Arsenic	10.4	4.3	19.0
Barium	124	91	306
Cadmium	2.2	1.2	4.6
Chromium	14.9	9.9	34.7
Lead	669	465	1599
Mercury	0.07	0.03	0.13
Selenium	1.0	0.2	1.4
Silver	0.16	0.10	0.36

* All values mg/kg

"B" Horizon Background Calculation

	Mean	Std Dev.	Background Conc.
Antimony	9.7	14.0	37.7
Arsenic	7.1	2.8	12.7
Barium	129	86	301
Cadmium	0.74	0.84	2.42
Chromium	18.5	5.0	28.5
Lead	212	277	766
Mercury	0.05	0.0	0.05
Selenium	0.68	0.30	1.28
Silver	0.15	0.09	0.33

* All values mg/kg

TABLE 5-2

Beech Grove Closure Investigatoin
Soil and Sediment Sample Results

Sample Location	CSB-1A			CSB-1B			CSB-1C			CSB-2A			CSB-2B			CSB-2C			CSB-3A			CSB-3B			CSB-3C			CSB-3D		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			24-28" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1110	J	1.0	5390	J	1.0	19	J	1.0	1320		1.0	523		1.0	1860		1.0	1880	J	1.0	2360	J	1.0	1510	J	1.0	1270	J	1.0
Arsenic	406	J	1.0	599	J	1.0	8.0	J	1.0	266		1.0	159		1.0	469		1.0	284	J	1.0	565	J	1.0	217	J	1.0	193	J	1.0
Barium	148		1.0	251		1.0	56		1.0	210		1.0	136		1.0	264		1.0	123		1.0	160		1.0	174		1.0	158		1.0
Cadmium	94	J	0.50	148	J	0.50	3.3	J	0.50	99		0.50	70		0.50	98		0.50	124	J	0.50	167	J	0.50	68	J	0.50	57	J	0.50
Chromium	6.9	J	1.0	8.0	J	1.0	9.0	J	1.0	9.3		1.0	11		1.0	12		1.0	9.8	J	1.0	8.4	J	1.0	12	J	1.0	17	J	1.0
Lead	139000	J	0.60	268000	J	0.60	511	J	0.60	175000		0.60	58400		0.60	180000		0.60	121000	J	0.60	150000	J	0.60	78100	J	0.60	93900	J	0.60
Mercury	0.52		0.10	2.0		0.10		U	0.10	0.53		0.10	0.19		0.10	0.64		0.10	0.56	U	0.1	3.7	U	0.10	0.33	U	0.10	0.48	U	0.1
Selenium	42		0.50	72		0.50	0.63		0.50	10		0.50	2.7		0.50	27		0.50	22		0.50	38		0.50	24		0.50	20		0.50
Silver	1.9	J	0.20	3.2	J	0.20		UJ	0.20	0.90		0.20	0.29		0.20	1.7		0.20	0.98	J	0.20	0.50	J	0.20	0.66	J	0.20	1.4		0.20

Sample Location	CSB-3E			CSB-4A			CSB-4B			CSB-4BD			CSB-4C			CSB-5A			CSB-5B			CSB-5C			CSB-6A			CSB-6B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	36-39" bgs			0-3" bgs			6-9" bgs			FD of CSB-4B			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	9.7	U	1.0	2400	J	1.0	1000	J	1.0	34	J	1.0	3.2	J	1.0	6.4		1.0	3.0		1.0	1.2		1.0	13		1.0	2.0		1.0
Arsenic	12	J	1.0	690	J	1.0	164	J	1.0	25	J	1.0	6.8	J	1.0	7.2		1.0	7.1		1.0	5.1		1.0	8.9		1.0	9.6		1.0
Barium	146		1.0	266		1.0	123		1.0	158		1.0	76		1.0	66		1.0	79		1.0	74		1.0	67		1.0	85		1.0
Cadmium		UJ	0.50	138	J	0.50	102	J	0.50	29	J	0.50		UJ	0.50		U	0.50		U	0.50		U	0.50	0.51		0.50		U	0.50
Chromium	27	J	1.0	14	J	1.0	13	J	1.0	30	J	1.0	14	J	1.0	13		1.0	14		1.0	15		1.0	11		1.0	18		1.0
Lead	232	J	0.60	192000	J	0.60	460000	J	0.60	2450	J	0.60	65	U	0.60	125	J	0.60	67	U	0.60	42	U	0.60	165	J	0.60	50	U	0.60
Mercury		U	0.10	0.70		0.10	0.23		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	1.8		0.50	36		0.50	1.9		0.50	1.2		0.50	0.61		0.50		U	0.50	0.53		0.50		U	0.50	1.6		0.50	0.52		0.50
Silver		U	0.20	2.5	J	0.20	0.50	J	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20

Sample Location	CSB-6C			CSB-7A			CSB-7B			CSB-7C			CSB-7CD			CSB-7D			CSB-7E			CSB-8A			CSB-8B			CSB-8C		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-7C			24-28" bgs			36-39" bgs			0-3" bgs			6-9" bgs			12-15" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	3.9		1.0	826		1.0	2070		1.0	904		1.0	1140		1.0	6.5	U	1.0	5.0	U	1.0	486		1.0	38		1.0	13	U	1.0
Arsenic	11		1.0	81		1.0	788		1.0	343		1.0	430		1.0	6.9		1.0	6.2		1.0	66		1.0	10		1.0	10		1.0
Barium	76		1.0	39		1.0	207		1.0	134		1.0	113		1.0	44		1.0	45		1.0	101		1.0	62		1.0	39		1.0
Cadmium		U	0.50	20		0.50	163		0.50	158		0.50	163		0.50	0.61		0.50		U	0.50	12		0.50	2.5		0.50	1.2		0.50
Chromium	22		1.0	14		1.0	18		1.0	16		1.0	12		1.0	8.7		1.0	8.4		1.0	5.6		1.0	13		1.0	9.5		1.0
Lead	69	U	0.60	255000	J	0.60	154000	J	0.60	77200	J	0.60	144000	J	0.60	114		0.60	19	U	0.60	83800		0.60	989		0.60	279		0.60
Mercury		U	0.10	2.9		0.10	0.87		0.10	0.73		0.10	0.61		0.10		U	0.10		U	0.10	0.51	J	0.10		U	0.10		U	0.10
Selenium	0.62		0.50	20		0.50	9.4		0.50	12		0.50	9.9		0.50		U	0.50	0.63		0.50	7.4		0.50	0.80		0.50	0.65		0.50
Silver		UJ	0.20	11	J	0.20	1.7	J	0.20	1.5	J	0.20	1.9	J	0.20		U	0.20		U	0.20	1.1		0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
R - Denotes a rejected result.
FD - Field duplicate.

TABLE 5-2

Beech Grove Closure Investigatoin
Soil and Sediment Sample Results

Sample Location	CSB-9A			CSB-9B			CSB-9C			CSB-9CD			CSB-10A			CSB-10B			CSB-10C			CSB-10CD			CSB-10D			CSB-11A		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-9C			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-10C			24-28" bgs			0-3" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	6.9		1.0	2.2		1.0	1.2		1.0	4.3		1.0	1280	J	1.0	3040	J	1.0	43	J	1.0	4.9	J	1.0	16	U	1.0	1300	J	1.0
Arsenic	12		1.0	11		1.0	7.7		1.0	7.4		1.0	709	J	1.0	916	J	1.0	17	J	1.0	8.7	J	1.0	6.9	J	1.0	237	J	1.0
Barium	84		1.0	206		1.0	76		1.0	69		1.0	197		1.0	308		1.0	138		1.0	96		1.0	99		1.0	194		1.0
Cadmium		U	0.50	8.5		0.50		U	0.50		U	0.50	225		0.50	1080		0.50	151		0.50	156		0.50		U	0.50	86		0.50
Chromium	20		1.0	26		1.0	13		1.0	12		1.0	14		1.0	9.6		1.0	20		1.0	15		1.0	19		1.0	13		1.0
Lead	289		0.60	132		0.60	53	U	0.60	50	U	0.60	132000	J	0.60	236000	J	0.60	1500	J	0.60	362	J	0.60	548	J	0.60	10400	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	1.3		0.10	1.4		0.10			0.10		U	0.10		U	0.10	0.57		0.10
Selenium	0.91		0.50	1.2	J	0.50	0.71	J	0.50	0.73		0.50	62		0.5	111		0.5	1.6		0.5	0.98		0.5	1.4		0.50	16		0.5
Silver		U	0.20		U	0.20		U	0.20		U	0.20	1		0.2	1.8		0.2		U	0.2		U	0.2		U	0.20	1		0.2

Sample Location	CSB-11B			CSB-11C			CSB-12A			CSB-12B			CSB-12C			CSB-13A			CSB-13B			CSB-13C			CSB-14A			CSB-14B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	2420	J	1.0	28	J	1.0	9600	J	1.0	7610	J	1.0	15	J	1.0	94		1.0	7.8		1.0	2.2		1.0	1.4	U	1.0		U	1.0
Arsenic	585	J	1.0	14	J	1.0	1050	J	1.0	2270	J	1.0	14	J	1.0	38		1.0	11		1.0	10		1.0	2.2		1.0	5.7		1.0
Barium	146		1.0	173		1.0	30		1.0	435		1.0	202		1.0	212		1.0	122		1.0	120		1.0	85		1.0	53		1.0
Cadmium	151		0.50	3.4		0.50	313		0.50	421		0.50	0.94		0.50	19		0.50	26		0.50	199		0.50		U	0.50		U	0.50
Chromium	15		1.0	19		1.0	5.6		1.0	7.7		1.0	21		1.0	25		1.0	22		1.0	19		1.0	12		1.0	9.6		1.0
Lead	351000	J	0.60	522	J	0.60	467000	J	0.60	372000	J	0.60	353	J	0.60	323		0.60	30	U	0.60	49	U	0.60	28	U	0.6	9.8	U	0.6
Mercury	0.75		0.10		U	0.10	2.9		0.10	3.8		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	367		0.5	1.9	J	0.50	94		0.50	5.6		0.50	1.9		0.50	0.85	J	0.50	0.74	J	0.50	0.83	J	0.50		U	0.50		U	0.50
Silver	5		0.2		U	0.20	3.0		0.20	4.0		0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-14C			CSB-15A			CSB-15B			CSB-15C			CSB-15CD			CSB-16A			CSB-16B			CSB-16C			CSB-17A			CSB-17B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-15C			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.0	U	1.0	1.5	U	1.0	2.9	U	1.0	2.3	U	1.0	3.3	U	1.0	2.4	U	1.0	1.8	U	1.0	3.2	U	1.0	1.3	U	1.0	1.1	U	1.0
Arsenic	6.4		1.0	7.0		1.0	7.8		1.0	5.3		1.0	6.1		1.0	6.0		1.0	7.2		1.0	7.5		1.0	7.3		1.0	7.1		1.0
Barium	69		1.0	48		1.0	50		1.0	47		1.0	51		1.0	166		1.0	69		1.0	58		1.0	62		1.0	77		1.0
Cadmium		U	0.50	0.64		0.50	1.3		0.50		U	0.50		U	0.50		U	0.50		U	0.50	0.53		0.50		U	0.50		U	0.50
Chromium	11		1.0	9.9		1.0	12		1.0	9.6		1.0	12		1.0	16		1.0	11		1.0	11		1.0	11		1.0	14		1.0
Lead	18	U	0.6	9.6	U	0.60	89		0.60	28		0.60	30		0.60	209	J	0.60	195	J	0.60	234	J	0.60	87	J	0.60	20	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium		U	0.50	0.78		0.50		U	0.50		U	0.50		U	0.50	0.92		0.50		U	0.50		U	0.50	0.63		0.50		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
R - Denotes a rejected result.
FD - Field duplicate.

TABLE 5-2

Beech Grove Closure Investigatoin
Soil and Sediment Sample Results

Sample Location	CSB-17C			CSB-17CD			CSB-18A			CSB-18B			CSB-18C			CSB19-A			CSB-19B			CSB-19C			CSB-19CD			CSB-20A		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			FD of CSB-17C			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-19C			0-3" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.2	U	1.0	1.2	U	1.0	1.2		1.0			1.0	1.0		1.0	6.0		1.0	6.6		1.0	1.4		1.0	2.2		1.0	1.8	U	1.0
Arsenic	6.9		1.0	7.0		1.0	7.8		1.0	6.0		1.0	8.3		1.0	9.0		1.0	6.8		1.0	6.7		1.0	6.8		1.0	9.6		1.0
Barium	53		1.0	55		1.0	67		1.0	63		1.0	58		1.0	65		1.0	61		1.0	47		1.0	53		1.0	73		1.0
Cadmium	0.52		0.50		U	0.50	1.1		0.50	0.63		0.50	0.71		0.50	1.7		0.50	0.79		0.50	1.3		0.50	0.66		0.50	1.4		0.50
Chromium	11		1.0	10		1.0	12		1.0	12		1.0	12		1.0	13		1.0	15		1.0	11		1.0	12		1.0	11		1.0
Lead	101	J	0.60	273	J	0.60	70	J	0.60	26	J	0.60	38	J	0.60	187	J	0.60	79	J	0.60	129	J	0.60	68	J	0.60	30	J	0.60
Mercury		U	0.10		U	0.10	0.32		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.59		0.50	0.65		0.50	0.64		0.50		U	0.50		U	0.50	1.3		0.50	1.6	J	0.50	1.4	J	0.50	0.75		0.50	1.0		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-20B			CSB-20C			CSB-21A			CSB-21B			CSB-21C			CSB-22A			CSB-22B			CSB-22C			CSB-23A			CSB-23B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	1		U	1.0		U	1.0	1.3		1.0		U	1.0		U	1.0	4.0		1.0	3.8		1.0	1.3		1.0		U	1.0
Arsenic	6.9		1.0	2.4		1.0	7.8	J	1.0	9.3	J	1.0	6.8	J	1.0	6.3	J	1.0	6.7	J	1.0	6.6	J	1.0	7.5	J	1.0	7.0	J	1.0
Barium	64		1.0	41		1.0	204	J	1.0	152	J	1.0	56	J	1.0	56		1.0	59		1.0	62		1.0	89		1.0	248		1.0
Cadmium		U	0.50		U	0.50	0.68		0.50	1.3		0.50	1.2		0.50		U	0.50		U	0.50		U	0.50		U	0.50	0.66		0.50
Chromium	11		1.0	6.6		1.0	18	J	1.0	16	J	1.0	9.2	J	1.0	50		1.0	10	U	1.0	9.3	U	1.0	12	U	1.0	9.1	U	1.0
Lead	19	U	0.60	23	J	0.60	31	J	0.60	329	J	0.60	32	J	0.60	8.0	J	0.60	7.7	J	0.60	9.8	J	0.60	10	J	0.60	11	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium		U	0.50		U	0.50		UJ	0.50	0.66	J	0.50		UJ	0.50	0.58	J	0.50	0.57	J	0.50	0.72	J	0.50	0.78	J	0.50	0.75	J	0.50
Silver		U	0.20		U	0.20		UJ	0.20		UJ	0.20		UJ	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-23C			CSB-23CD			CSB-24A			CSB-24B			CSB-24C			CSB-25A			CSB-25B			CSB-25C			CSB-26A			CSB-26B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			FD of CSB-23C			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.0		1.0		U	1.0		U	1.0	5.5		1.0		U	1.0	9.1		1.0	57		1.0	3.4		1.0	4.6		1.0	6.1		1.0
Arsenic	6.2	J	1.0	6.1	J	1.0	4.8	J	1.0	9.3	J	1.0	4.4	J	1.0	13		1.0	75		1.0	8.8		1.0	7.7		1.0	6.5		1.0
Barium	42		1.0	44		1.0	83		1.0	101		1.0	116		1.0	43	J	1.0	40	J	1.0	46	J	1.0	47		1.0	46		1.0
Cadmium		U	0.50		U	0.50		U	0.50		U	0.50		U	0.50	3.9		0.50	26		0.50	0.89		0.50	1.6		0.50	0.76		0.50
Chromium	8.0	U	1.0	8.3	U	1.0	12	U	1.0	22	U	1.0	17	U	1.0	13	J	1.0	8.5	J	1.0	8.7	J	1.0	12		1.0	9.7		1.0
Lead	32	J	0.60	8.0	J	0.60	28	J	0.60	20	J	0.60	12	J	0.60	411	J	0.60	2420	J	0.60	108	J	0.60	191	J	0.60	73	U	0.6
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium		UJ	0.50	0.62	J	0.50	0.55	J	0.50	1.1	J	0.50	0.92	J	0.50	2.3	J	0.50	1.6	J	0.50	0.71		0.50	4.5	J	0.50	0.98		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
R - Denotes a rejected result.
FD - Field duplicate.

TABLE 5-2

Beech Grove Closure Investigatoin
Soil and Sediment Sample Results

Sample Location	CSB-26C			CSB-27A			CSB-27B			CSB-27C			CSB-28A			CSB-28B			CSB-28C			CSB-28CD			CSB-29A			CSB-29B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-28C			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	4.1		1.0	3.3		1.0		U	1.0		U	1.0		U	1.0		U	1.0	1.7		1.0		U	1.0	1.6		1.0	2.3		1.0
Arsenic	8.6		1.0	6.3		1.0	8.5		1.0	6.4		1.0	4.4	J	1.0	10	J	1.0	23	J	1.0	8.7	J	1.0	9.2	J	1.0	25	J	1.0
Barium	48		1.0	46	J	1.0	22	J	1.0	20	J	1.0	65	J	1.0	164	J	1.0	534	J	1.0	190	J	1.0	59	J	1.0	192	J	1.0
Cadmium	6.7		0.50		U	0.50		U	0.50		U	0.50		U	0.50		U	0.50	0.83		0.50		U	0.50		U	0.50	0.72		0.50
Chromium	11		1.0	9.4	J	1.0	5.8	J	1.0	5.7	J	1.0	10	J	1.0	29	J	1.0	61	J	1.0	18	J	1.0	17	J	1.0	44	J	1.0
Lead	583	J	0.60	22	J	0.60	13	J	0.60	14	J	0.60	14	J	0.60	19	J	0.60	29	J	0.60	10	J	0.60	32	J	0.60	44	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	3.8		0.50	0.75		0.50	0.68	J	0.50	0.70		0.50		UJ	0.50	1.2	J	0.50	3.4	J	0.50	1.4	J	0.50	0.92	J	0.50	3.3	J	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20

Sample Location	CSB-29C			CSB-30A			CSB-30B			CSB-30C			CSB-30CD			CSB-31A			CSB-31B			CSB-31C			CSB-32A			CSB-32B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-30C			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.5		1.0	1.1	J	1.0		UJ	1.0	1.0	J	1.0	741	J	1.0	11		1.0	15		1.0		U	1.0		U	1.0	4.6		1.0
Arsenic	11	J	1.0	9.5		1.0	6.7		1.0	11		1.0	8.6		1.0	14		1.0	22		1.0	6.7	J	1.0	388		1.0	7.4		1.0
Barium	100	J	1.0	96	J	1.0	58	J	1.0	97	J	1.0	62	J	1.0	75	J	1.0	103	J	1.0	54		1.0	120	J	1.0	44	J	1.0
Cadmium	0.73		0.50	0.56		0.50		U	0.50		U	0.50		U	0.50		U	0.50	1.5		0.50		U	0.50	86		0.50	0.60		0.50
Chromium	21	J	1.0	16		1.0	10		1.0	21		1.0	14		1.0	18		1.0	14		1.0	9.5	U	1.0	14		1.0	8.8		1.0
Lead	36	J	0.60	16	J	0.60	13	J	0.60	15	J	0.60	24	J	0.60	431	J	0.60	2280	J	0.60	10		0.60	42800	J	0.60	403	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	0.28		0.10		U	0.10
Selenium	1.3	J	0.50	1.5		0.50	0.53		0.50	1.0		0.50	1.1		0.50	0.92		0.50	0.96		0.50	0.75	J	0.50	15		0.50	0.89		0.50
Silver		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		U	0.20	0.86	J	0.20		UJ	0.20

Sample Location	CSB-32C			CSB-33A			CSB-33B			CSB-33C			CSB-34A			CSB-34B			CSB-34C			CSB-34CD			CSB-35A			CSB-35B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-34C			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	2.1		1.0	6.8		1.0	4.5		1.0	2.7		1.0	821		1.0	36		1.0	1.6		1.0	1.6		1.0	42		1.0	8.7		1.0
Arsenic	7.0		1.0	13		1.0	12		1.0	13		1.0	189		1.0	9.1		1.0	7.0		1.0	6.5		1.0	8.4		1.0	9.5		1.0
Barium	41	J	1.0	80		1.0	139		1.0	124		1.0	338		1.0	49		1.0	40		1.0	44		1.0	65		1.0	47		1.0
Cadmium		U	0.50	2.2		0.50	2.3		0.50	4.4		0.50	84		0.50	2.0		0.50		U	0.50		U	0.50	3.6		0.50	0.79		0.50
Chromium	9.1		1.0	25		1.0	17		1.0	21		1.0		U	1.0	9.6		1.0	9.0		1.0	9.6		1.0	12		1.0	9.5		1.0
Lead	694	J	0.60	196		0.60	868		0.60	245		0.60	94500		0.60	2360		0.60	68		0.60	86		0.60	3090		0.60	518	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	0.25		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.60		0.50	1.6		0.50	0.84		0.50	0.74		0.50	3.6	J	0.50	0.66		0.50		U	0.50	0.60		0.50	1.2		0.50	0.73		0.50
Silver		UJ	0.20		U	0.20		U	0.20		U	0.20	2.2		0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
R - Denotes a rejected result.
FD - Field duplicate.

TABLE 5-2

Beech Grove Closure Investigatoin
Soil and Sediment Sample Results

Sample Location	CSB-35C			CSB-35CD			CSB-35D			CSB-35E			CSB-35F			CSB-36A			CSB-36B			CSB-36C			CSB-37A			CSB-37B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			FD of CSB-35C			24-28" bgs			36-39" bgs			48-51" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	16		1.0	15		1.0	67		1.0	99		1.0	55		1.0	2.2		1.0	2.0		1.0	1.6		1.0	3.8		1.0	23		1.0
Arsenic	7.0		1.0	7.9		1.0	12		1.0	15		1.0	12		1.0	170		1.0	15		1.0	12		1.0	30		1.0	7.9		1.0
Barium	41		1.0	45		1.0	62		1.0	49		1.0	48		1.0	94		1.0	128		1.0	141		1.0	65		1.0	43		1.0
Cadmium	1.2		0.50	1.4		0.50	3.6		0.50	5.6		0.5	3.2		0.5	3.1		0.50		U	0.50		U	0.50	126		0.50	3.9		0.50
Chromium	7.2		1.0	7.7		1.0	10		1.0	9.3		1.0	10		1.0	20		1.0	21		1.0	21		1.0	12		1.0	8.2		1.0
Lead	1400	J	0.60	1120	J	0.60	10800		0.60	4910		0.6	3010		0.6	103		0.60	76		0.60	67		0.60	325	J	0.60	314	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		R	0.1		R	0.1		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.77		0.50	0.68		0.50	1.1		0.50	1.1		0.5	1.4		0.5	7.5		0.50	1.2		0.50	1.2		0.50	1.6		0.50		U	0.50
Silver		U	0.20		U	0.20		U	0.20		UJ	0.2	UJ		0.2		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-37C			CSB-38A			CSB-38B			CSB-38C			CSB-38CD			CSB-39A			CSB-39B			CSB-39C			CSB-39CD			CSB-40A		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-38C			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-39C			0-3" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	2.6		1.0		U	1.0		U	1.0		U	1.0		U	1.0	8550		1.0	7.3		1.0	1.4		1.0	1.4		1.0	313		1.0
Arsenic	6.8		1.0	4.9	J	1.0	4.4		1.0	7.8		1.0	8.4		1.0	863	J	1.0	8.0	J	1.0	5.8	J	1.0	9.0	J	1.0	39	J	1.0
Barium	47		1.0	75	J	1.0	149		1.0	169		1.0	164		1.0	132		1.0	54		1.0	44		1.0	43		1.0	62		1.0
Cadmium	1.9		0.50		U	0.50		U	0.50		U	0.50		U	0.50	39		0.50		U	0.50		U	0.50		U	0.50	24		0.50
Chromium	7.1		1.0	178		1.0	117		1.0	75		1.0	64		1.0	1.5		1.0	10		1.0	9.9		1.0	8.4		1.0	4.9		1.0
Lead	242	J	0.60	22	J	0.60	15	U	0.60	19	U	0.60	17	U	0.60	46800	J	0.60	69	J	0.60	15	U	0.6	15	U	0.6	6660	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	0.14		0.10		U	0.10		U	0.10		U	0.10	0.11		0.10
Selenium		U	0.50	0.76	J	0.50	1.4		0.50	0.53		0.50	0.70		0.50	21		0.50	0.84		0.50		U	0.50	0.54		0.50		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20	0.46		0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-40B			CSB-40C			CSB-41A			CSB-41B			CSB41-C			CSB-42A			CSB-42B			CSB-42C			CSB-43A			CSB-43B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.3		1.0	1.2		1.0	2.0		1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0	7.4		1.0
Arsenic	6.4	J	1.0	11	J	1.0	4.8	J	1.0	7.6	J	1.0	6.3	J	1.0	23		1.0	73		1.0	7.8		1.0	10		1.0	9.3		1.0
Barium	132		1.0	96		1.0	51		1.0	105		1.0	57		1.0	25		1.0	42		1.0	51		1.0	77		1.0	45		1.0
Cadmium	11		0.50		U	0.50	0.87		0.50		U	0.50		U	0.50	7.0		0.50	1.7		0.50	0.41		0.50		U	0.50	1.1		0.50
Chromium	11		1.0	15		1.0	27		1.0	12		1.0	9.2		1.0	4.2		1.0	7.6		1.0	7.7		1.0	17		1.0	11		1.0
Lead	20	U	0.6	14	U	0.6	45	J	0.60	8.9	U	0.6	8.8	U	0.6	11	U	0.6	11	U	0.6	15	U	0.6	14	J	0.60	106	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium		U	0.50	0.67		0.50	0.91		0.50		U	0.50	0.57		0.50		U	0.50	0.93		0.50		U	0.50	0.77	J	0.50	0.81		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
R - Denotes a rejected result.
FD - Field duplicate.

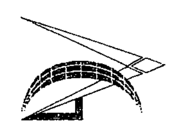


TABLE 5-2

Beech Grove Closure Investigatoin
Soil and Sediment Sample Results

Sample Location	CSB-43C			CSB-44A			CSB-44B			CSB-44C			CSB-44CD			CSB-45A			CSB-45B			CSB-45C			CSB-46A			CSB-46B			CSB-46C		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-44C			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	1.0		U	1.0	1.5		1.0		U	1.0		U	1.0	1.5		1.0	1.1		1.0		U	1.0		U	1.0		U	1.0		U	1.0
Arsenic	6.6		1.0	7.8		1.0	7.2		1.0	7.6		1.0	6.2		1.0	7.9		1.0	10		1.0	7.2		1.0	8.9		1.0	6.9		1.0	9.1		1.0
Barium	48		1.0	56		1.0	50		1.0	50		1.0	45		1.0	74		1.0	71		1.0	49		1.0	65		1.0	41		1.0	47		1.0
Cadmium		U	0.50		U	0.50	0.69		0.50		U	0.50		U	0.50		U	0.50	0.62		0.50		U	0.50	0.53		0.50		U	0.50	0.81		0.50
Chromium	13		1.0	14		1.0	13		1.0	13		1.0	8.7		1.0	15		1.0	15		1.0	11		1.0	10		1.0	8.1		1.0	11		1.0
Lead	24	J	0.60	32	J	0.60	12	J	0.60	20	J	0.60	11	J	0.60	27		0.60	12		0.60	9.9	U	0.60	12	J	0.60	12	J	0.60	9.7	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.79		0.50	1.6		0.50	0.76		0.50	0.85		0.50	1.4		0.50	1.8		0.50	1.6		0.50	1.8		0.50	1.3		0.50	0.74		0.50	0.66		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-47A			CSB-47B			CSB-47C			CSB-47CD			CSB-49A			CSB-49B			CSB-49C			CSB-50A			CSB-50B			CSB-50C			CSB-50CD		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-47C			0-3" bgs			6-9" bgs			12-15" bgs			0-3" bgs			6-9" bgs			12-15" bgs			FD of CSB-50C		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	4.1		1.0		U	1.0		U	1.0		U	1.0	4.0		1.0		U	1.0	1.5		1.0	17		1.0	1.9		1.0	3.8		1.0	2.0		1.0
Arsenic	25		1.0	6.8		1.0	5.9		1.0	6.4		1.0	8.1		1.0	6.4		1.0	6.8		1.0	15		1.0	13		1.0	10		1.0	11		1.0
Barium	53		1.0	47		1.0	41		1.0	43		1.0	56		1.0	56		1.0	43		1.0	180	J	1.0	100	J	1.0	168	J	1.0	133	J	1.0
Cadmium		U	0.50		U	0.50		U	0.50		U	0.50	0.56		0.50		U	0.50		U	0.50	1.0		0.50		U	0.50	0.56		0.50		U	0.50
Chromium	13		1.0	10		1.0	7.7		1.0	8.3		1.0	8.4		1.0	10		1.0	8.6		1.0	15	J	1.0	19	J	1.0	32	J	1.0	21	J	1.0
Lead	58		0.60	11	U	0.60	10	U	0.60	14		0.60	147		0.60	18	U	0.6	17	U	0.6	480	J	0.60	131	J	0.60	229	J	0.60	111	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	2.1	J	0.50	1.6		0.50	1.6		0.50	0.59		0.50	1.1	J	0.50		U	0.50		U	0.50	3.8		0.50	1.3		0.50	2.0	J	0.50	1.1		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-51A			CSB-51B			CSB-51C			CSB-51D			CSB-51E			CSB-51F			CSB-51G			CSED-1A			CSED-2A			CSED-3A			CSED-4A			CSED-4B		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Sediment			Sediment			Sediment			Sediment			Sediment		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Depth	0-3" bgs			6-9" bgs			12-15" bgs			24-28" bgs			36-39" bgs			48-51" bgs			60-63" bgs			0-6" bgs			0-6" bgs			0-6" bgs			0-6" bgs			FD of CSED-4A		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	873		1.0	86		1.0	79		1.0	282		1.0	47		1.0	182		1.0	81		1.0	837		1.0	2170		1.0	1910		1.0	199		1.0	204		1.0
Arsenic	265		1.0	187		1.0	17		1.0	36		1.0	26		1.0	18		1.0	15		1.0	653		1.0	229		1.0	368		1.0	189		1.0	182		1.0
Barium	228		1.0	81		1.0	69		1.0	123		1.0	69		1.0	55		1.0	50		1.0	45		1.0	118		1.0	100		1.0	62		1.0	58		1.0
Cadmium	28		0.50	6.0		0.50	4.4		0.50	8.1		0.50	3.4		0.50	6.5		0.5	3.6		0.5	250		0.50	351		0.50	268		0.50	22		0.50	30		0.50
Chromium	2.8		1.0	12		1.0	10		1.0	11		1.0	8.5		1.0	9		1.0	10		1.0	18		1.0	29		1.0	32		1.0	17		1.0	19		1.0
Lead	47300		0.60	10300		0.60	5680		0.60	18700		0.60	12000		0.60	8020		0.6	3800		0.6	43900		0.60	138000		0.60	16100		0.60	7390		0.60	11000		0.60
Mercury	0.14		0.10		U	0.10		U	0.10		U	0.10		U	0.10		R	0.1		R	0.6	1.9		0.10	2.5		0.10	6.6		0.10	0.24	J	0.10	0.61		0.10
Selenium	3.0	J	0.50	3.9		0.50	1.7		0.50	2.6		0.50	0.98		0.50	1.4		0.5	1.1		0.5	44		0.50	34		0.50	40		0.50	3.6		0.50	3.5		0.50
Silver	0.99		0.20	0.21		0.20	0.90		0.20	0.24		0.20		U	0.20	0.28	J	0.2		UJ	0.2	0.84		0.20	2.3		0.20	1.7		0.20		U	0.20	0.24		0.20

DL - Detection Limit prior to any dilutions.

Q - Qualifier.

U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.

J - Denotes an estimated result.

R - Denotes a rejected result.

TABLE 5-3

Closure Investigation Groundwater Sample Results (ug/l)

First Quarter Sampling Event - September 1999

Sample Location	MW-1			MW-2D			MW-2S			MW-3			MW-4			MW-5			MW-6S		
Matrix	aqueous			aqueous			aqueous			aqueous			aqueous			aqueous			aqueous		
Units	ug/l			ug/l			ug/l			ug/l			ug/l			ug/l			ug/l		
Comments																					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic	21		1	6.3		1	9.8		1	11		1	1.8		1	8.4		1	8.8	J	1
Barium	96		10	334		10	40		10	135		10	211		10	149		10	218		10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2	0.2		0.2
Chromium	1.8	U	1	5.2	U	1		U	1	1.1	U	1	3.1	U	1	1.5	U	1	26	U	1
Lead	1.8	U	1	10	U	1	11	U	1		U	1	1.7	U	1		U	1	21	U	1
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium	9		2		U	2	7.7		2	5.2		2		U	2		U	2	4.9	J	2
Silver		R	0.2		R	0.2		R	0.2		R	0.2		R	0.2		R	0.2		UJ	0.2

Sample Location	MW-6S			MW-6D			MW-16S*			MW-16S*			MW-6D-FB			MW-6D-EQ		
Matrix	aqueous			aqueous			aqueous			aqueous			aqueous			aqueous		
Units	ug/l			ug/l			ug/l			ug/l			ug/l			ug/l		
Comments	Dissolved									Dissolved			Field Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic	1.7		1	24		1	7.4	U	1	1.7		1		U	1		U	1
Barium	39		10	293		10	179		10	39		10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium	8.7	U	1	2	U	1	22	U	1	8	U	1		U	1	6.6		1
Lead		U	1	2.2	U	1	14	U	1		U	1		U	1	11		1
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium	2.9	J	2	2.1		2	5		2	2.6		2		U	2		U	2
Silver		U	0.2		R	0.2		UJ	0.2		U	0.2		U	0.2		U	0.2

Second Quarter Sampling Event - December 1999

Sample Location	MW-1			MW-2D			MW-2S			MW-12S			MW-3			MW-4			MW-5		
Matrix	aqueous			aqueous			aqueous			aqueous			aqueous			aqueous			aqueous		
Units	ug/l			ug/l			ug/l			ug/l			ug/l			ug/l			ug/l		
Comments										FD of MW-2S											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic	25		1	15		1	15		1	13		1	7.8		1	1.6		1	10		1
Barium	86		10	311		10	45		10	44		10	127		10	204		10	162		10
Cadmium		U	0.2		U	0.2	0.2		0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1		U	1	1.6		1	1.3		1		U	1		U	1	1.9		1
Lead		UJ	1	3.1	J	1	18		1	18		1		UJ	1		UJ	1		UJ	1
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium	7.3		2		U	2	6		2	6.8		2	5.3		2		U	2	2.9		2
Silver		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2

Sample Location	MW-6S			MW-6S			MW-6D			FB			EQ			EQB		
Matrix	aqueous			aqueous			aqueous			aqueous			aqueous			aqueous		
Units	ug/l			ug/l			ug/l			ug/l			ug/l			ug/l		
Comments				Dissolved						Field Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic	3.1		1	1.6		1	31		1		U	1		U	1		U	1
Barium	82		10	36		10	301		10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium	7.5		1		U	1		U	1		U	1		U	1		U	1
Lead	4.9	J	1		UJ	1	1.2	J	1		UJ	1		UJ	1		UJ	1
Mercury		U	0.2	0.2	U	0.2		U	0.2		U	0.2		U	0.2	0.2		0.2
Selenium	2.1		2		U	2		U	2		U	2		U	2		U	2
Silver		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2		UJ	0.2

DL - Detection limit prior to any dilutions.

Q - Qualifier.

R - Denotes a rejected detection limit or result.

U - The analyte was not detected at or above the detection limit.

Result + U - The result is qualitatively questioned due to the analyte in an associated blank at a similar concentration. The detection limit has been elevated and is reflected by the associated value.

UJ- Denotes an estimated detection limit.

J - Denotes an estimated result.

* Total and dissolved MW-16S samples are field duplicates of total and dissolved MW-6S.

TABLE 5-4
Tier 1 Default Remediation Values from IDEM RISC Technical Guidance Manual

				Region 9 PRGs from RFI	
Parameter	Soil Residential Value (mg/kg)	Soil Commercial/Industrial Value (mg/kg)	Groundwater Residential Value (mg/L)	Soil Industrial Value (mg/kg)	Water mg/l
Antimony	5.4	37	0.006	750	0.015
Arsenic	3.9	20	0.05	3	
Barium	1600	5900	2	100,000	2.6
Cadmium	7.5	77	0.005	930	0.018
Chromium	38	196	0.1	450	NA
Lead	81	227	0.015	1,000	0.004
Mercury	2.1	32	0.002	560	0.011
Selenium	5.2	53	0.05	9,400	0.18
Silver	31	87	0.18	9,400	0.18

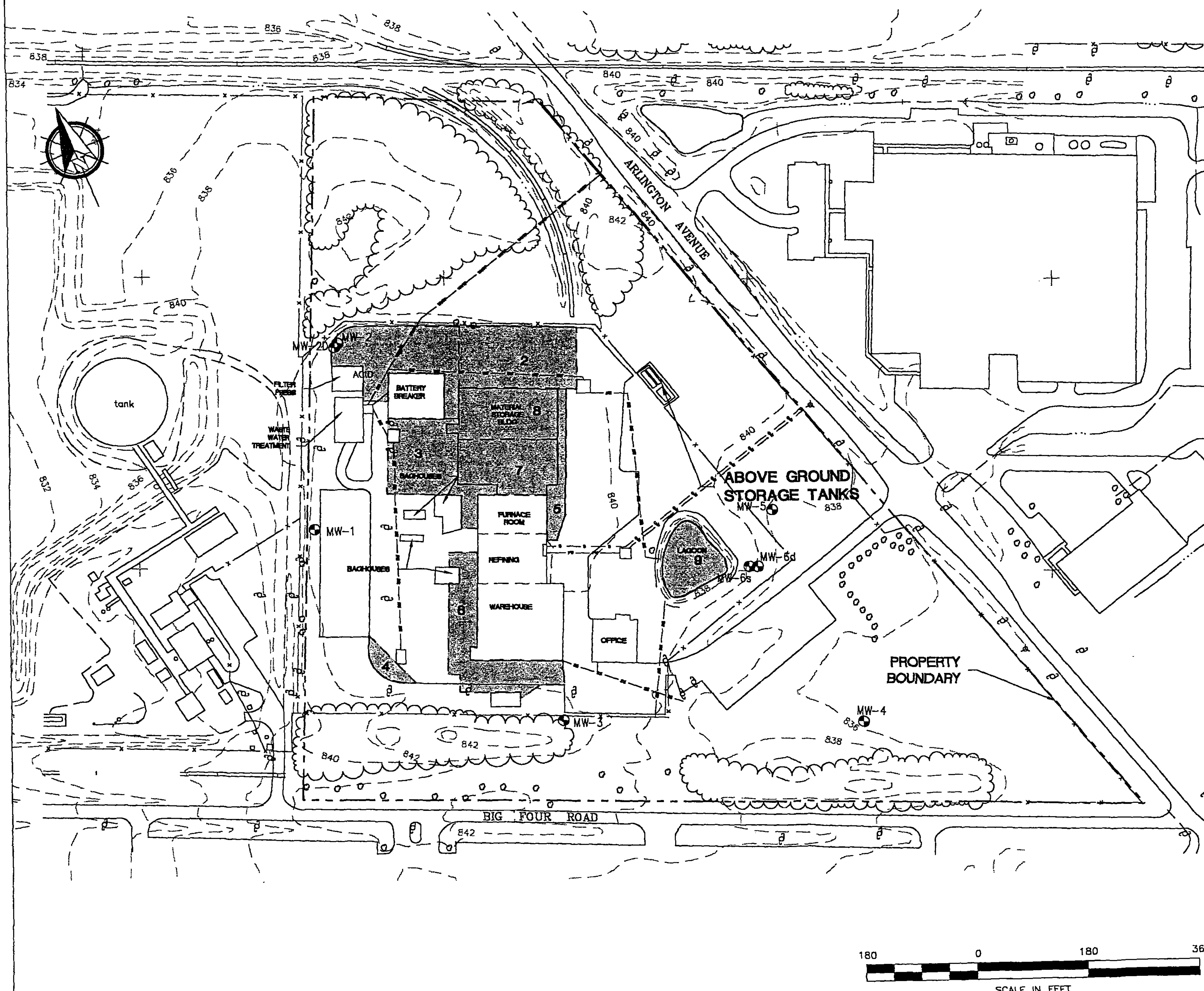
FIGURES

REF. U.S.G.S. 7 1/2 MINUTE
BEECH GROVE, IND
QUADRANGLE MAP

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA

Date: 10/12/98	SITE LOCATION MAP
Scale: N.T.S.	
Drawn By: P.S.G.	
Checked By: S.W.K.	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-28	
Issued:	Project No. 98-478-01 / FIGURE: 1-1

J:\REFINED METALS\DRAWINGS\9847801\98478-28



LEGEND

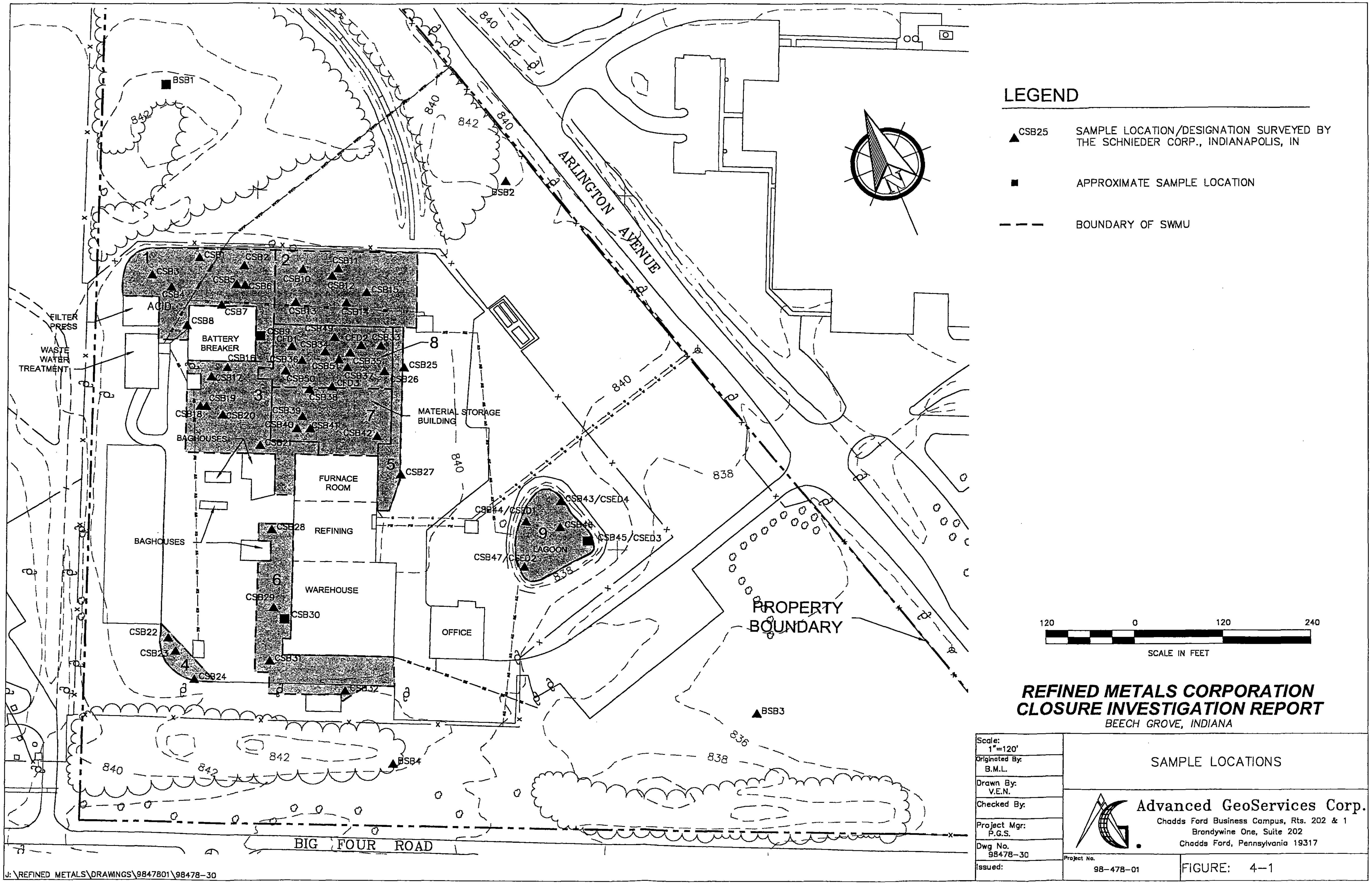
MONITORING WELL-SURVEYED BY THE SCHNEIDER CORP., INDIANAPOLIS, IN

BOUNDARY OF SAMPLING AREA SUBDIVISION WITHIN A SWMU

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA

Scale: 1"=180'	SITE PLAN
Originated By: B.L.	
Drawn By: V.E.N.	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Checked By:	
Project Mgr: P.G.S.	
Dwg No. 98478-29	Project No. 98-478-01
Issued:	FIGURE: 1-2

J:\REFINED METALS\DRAWINGS\9847801\98478-29



LEGEND
CSB25 SAMPLE LOCATION/DESIGNATION SURVEYED BY THE SCHNIEDER CORP., INDIANAPOLIS, IN
APPROXIMATE SAMPLE LOCATION
BOUNDARY OF SWMU
120 0 120 240
SCALE IN FEET
ARLINGTON AVENUE
BIG FOUR ROAD
PROPERTY BOUNDARY
FILTER PRESS
WASTE WATER TREATMENT
ACID
BATTERY BREAKER
BAGHOUSES
MATERIAL STORAGE BUILDING
FURNACE ROOM
REFINING
WAREHOUSE
OFFICE
LAGOON
BSB1
BSB2
BSB3
BSB4
CSB1
CSB2
CSB3
CSB4
CSB5
CSB6
CSB7
CSB8
CSB9
CSB10
CSB11
CSB12
CSB13
CSB14
CSB15
CSB16
CSB17
CSB18
CSB19
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CSB21
CSB22
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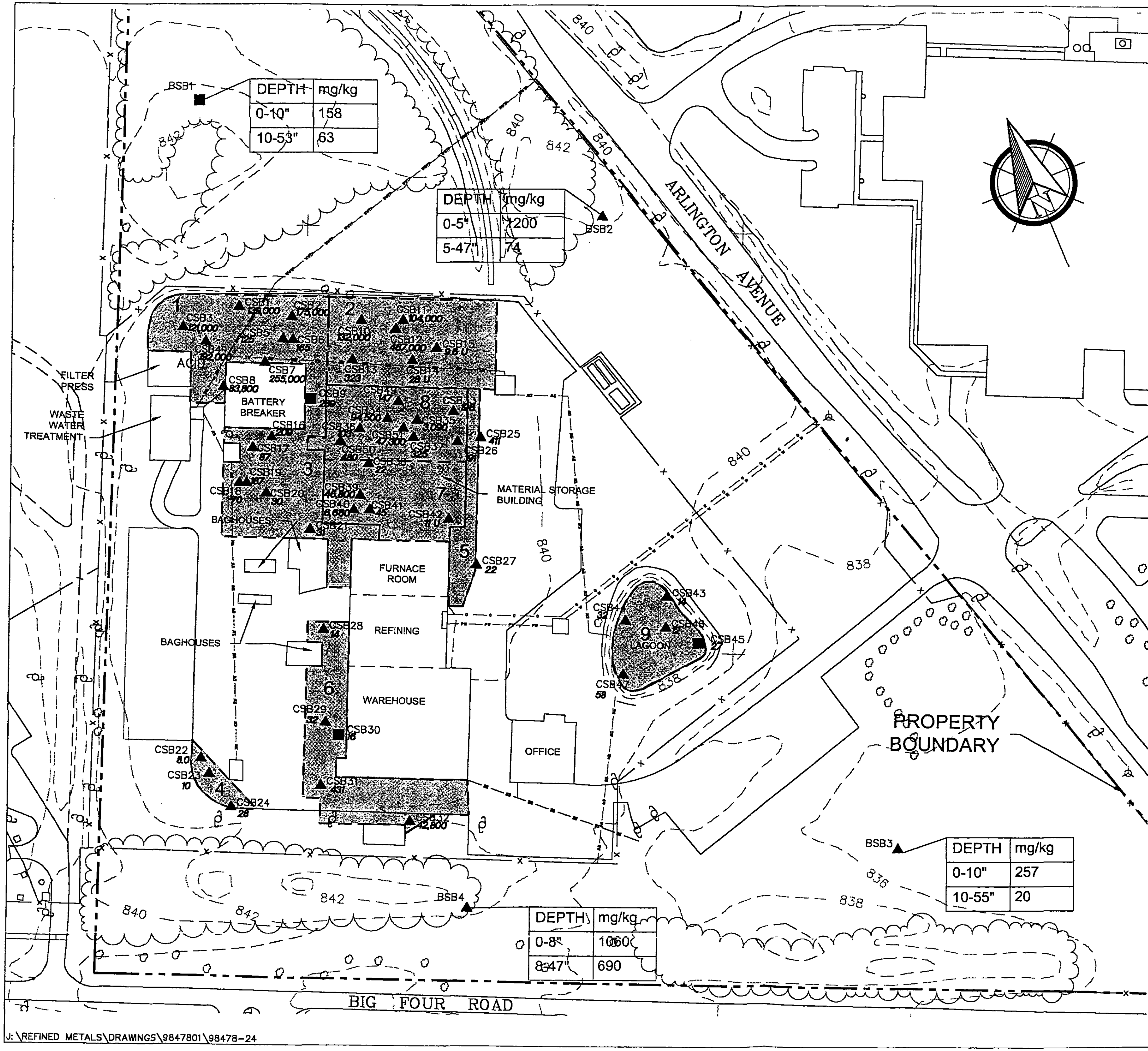
CSB31
CSB32
CSB33
CSB34
CSB35
CSB36
CSB37
CSB38
CSB39
CSB40
CSB41
CSB42
CSB43/CSED4
CSB44/CSED1
CSB45/CSED3
CSB46
CSB47/CSED2
CSB49
CSB50
CSB51
CFD1
CFD2
CFD3
1
2
3
4
5
6
7
8
9
836
838
840
842
REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA
Scale: 1"=120'
Originated By: B.M.L.
Drawn By: V.E.N.
Checked By:
Project Mgr: P.G.S.
Dwg No. 98478-30
Issued:
SAMPLE LOCATIONS
Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317
Project No. 98-478-01
FIGURE: 4-1
J:\REFINED METALS\DRAWINGS\9847801\98478-30



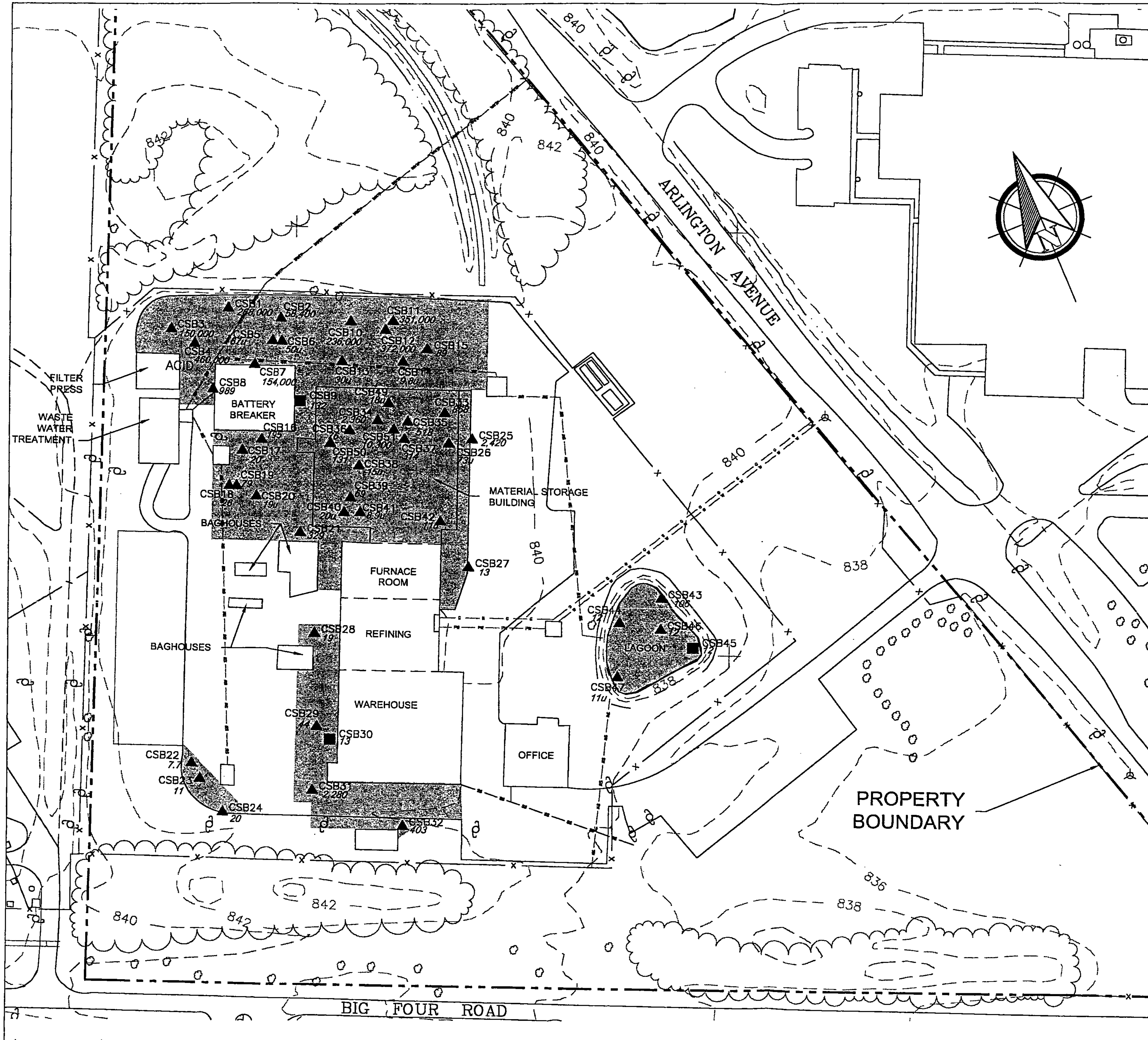
LEGEND

▲CSB25	SAMPLE LOCATION/DESIGNATION SURVEYED BY THE SCHNIEDER CORP., INDIANAPOLIS, IN
■	APPROXIMATE SAMPLE LOCATION NOT SURVEYED
32	ANALYTICAL RESULT–LEAD (MG/KG)
u	LEAD NOT DETECTED AT LIMIT OF QUANTITATION

120 0 120 240
SCALE IN FEET

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA

Scale: 1"=120'	SOIL SAMPLES LEAD CONCENTRATIONS (MG/KG) 0–3" BGS
Originated By: B.M.L.	
Drawn By: V.E.N.	
Checked By:	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-24	Project No. 98-478-01
Issued:	FIGURE: 5-1



LEGEND

▲CSB25	SAMPLE LOCATION/DESIGNATION SURVEYED BY THE SCHNIEDER CORP., INDIANAPOLIS, IN
■	APPROXIMATE SAMPLE LOCATION
13	ANALYTICAL RESULT–LEAD (MG/KG)
u	LEAD NOT DETECTED AT LIMIT OF QUANTITATION

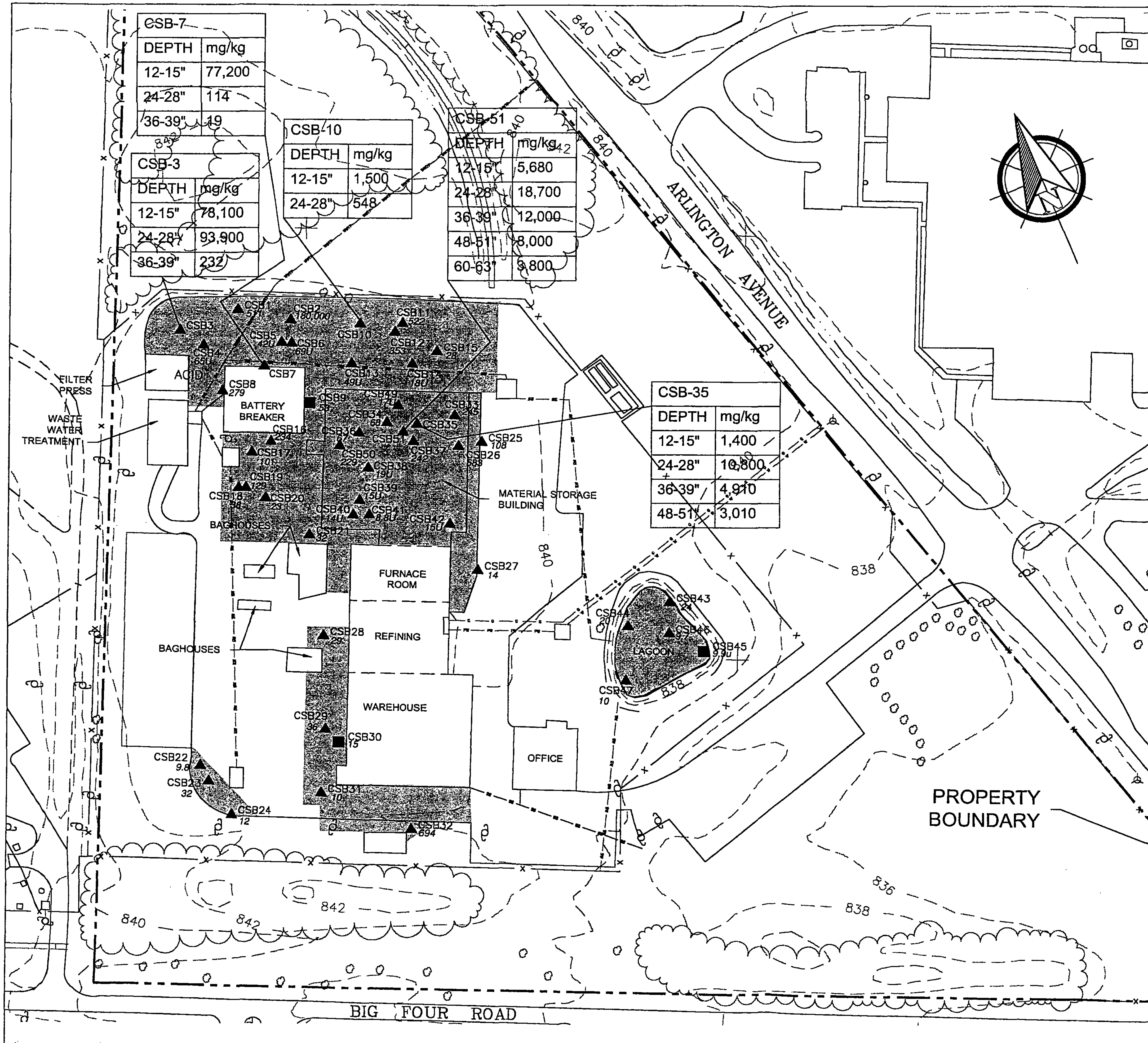
120 0 120 240

SCALE IN FEET

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA

Scale: 1"=120'	SOIL SAMPLES LEAD CONCENTRATIONS (MG/KG) 6–9" BGS
Originated By: B.M.L.	
Drawn By: V.E.N.	
Checked By:	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478–25	
Issued:	Project No. 98-478-01 — FIGURE: 5–2

J:\REFINED METALS\DRAWINGS\9847801\98478-25



CSB-7	
DEPTH	mg/kg
12-15"	77,200
24-28"	114
36-39"	19

CSB-3	
DEPTH	mg/kg
12-15"	78,100
24-28"	93,900
36-39"	232

CSB-10	
DEPTH	mg/kg
12-15"	1,500
24-28"	548

CSB-51	
DEPTH	mg/kg
12-15"	5,680
24-28"	18,700
36-39"	12,000
48-51"	8,000
60-63"	3,800

CSB-35	
DEPTH	mg/kg
12-15"	1,400
24-28"	10,800
36-39"	4,910
48-51"	3,010

LEGEND

▲CSB25	SAMPLE LOCATION/DESIGNATION SURVEYED BY THE SCHNIEDER CORP., INDIANAPOLIS, IN
■	APPROXIMATE SAMPLE LOCATION
14	ANALYTICAL RESULT–LEAD (MG/KG)
u	LEAD NOT DETECTED AT LIMIT OF QUANTITATION

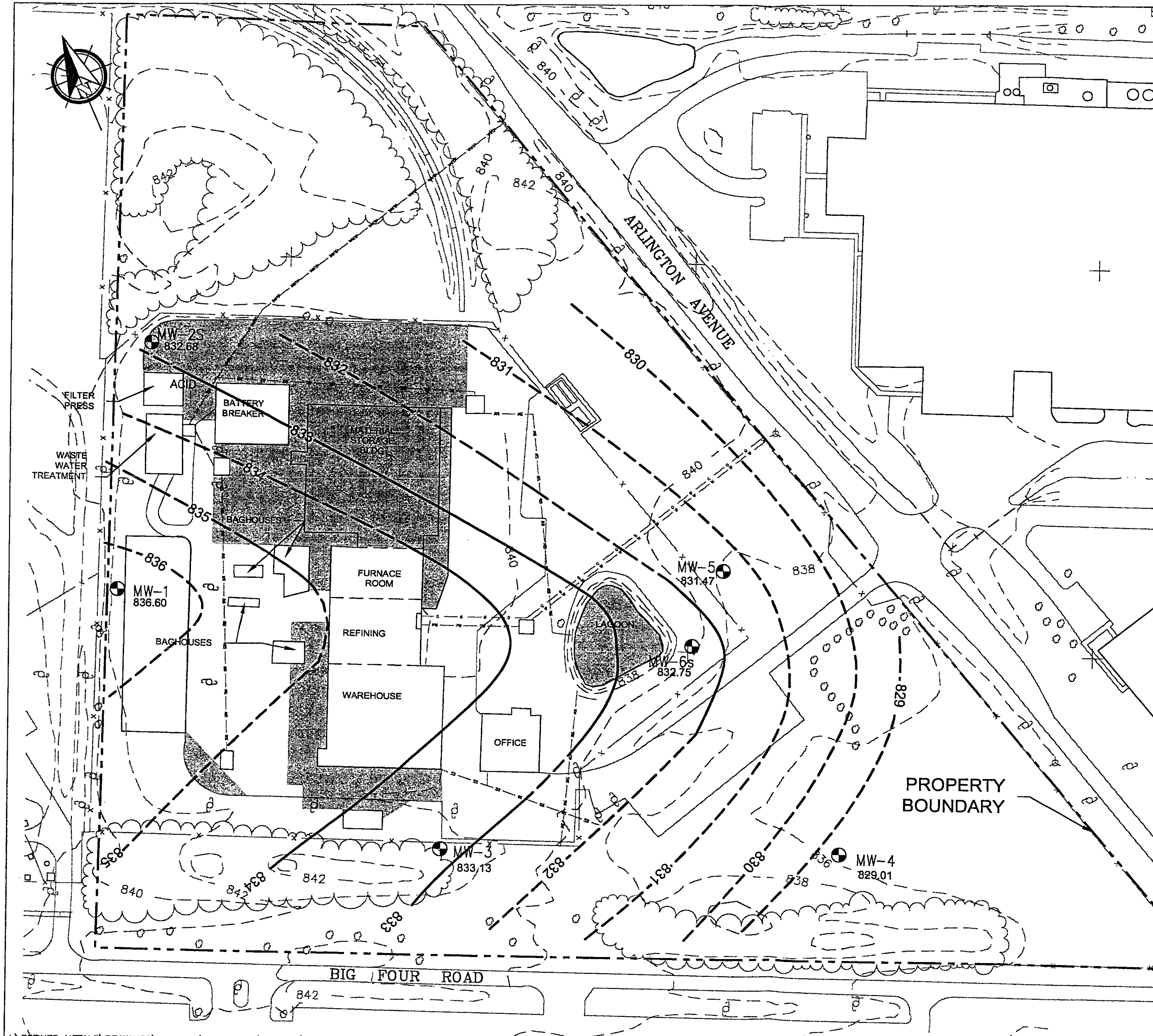
120 0 120 240

SCALE IN FEET

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT

BEECH GROVE, INDIANA

Scale: 1"=120'	SOIL SAMPLES LEAD CONCENTRATIONS (MG/KG) 12–15" BGS AND DEEPER
Originated By: B.M.L.	
Drawn By: V.E.N.	
Checked By:	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478–26	
Issued:	Project No. 98–478–01 — FIGURE: 5–3



LEGEND

SHALLOW MONITORING WELL-SURVEYED BY THE SCHNEIDER CORP., INDIANAPOLIS, IN

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA

POTENTIOMETRIC SURFACE MAP
FOR SHALLOW GROUNDWATER
9/21/99

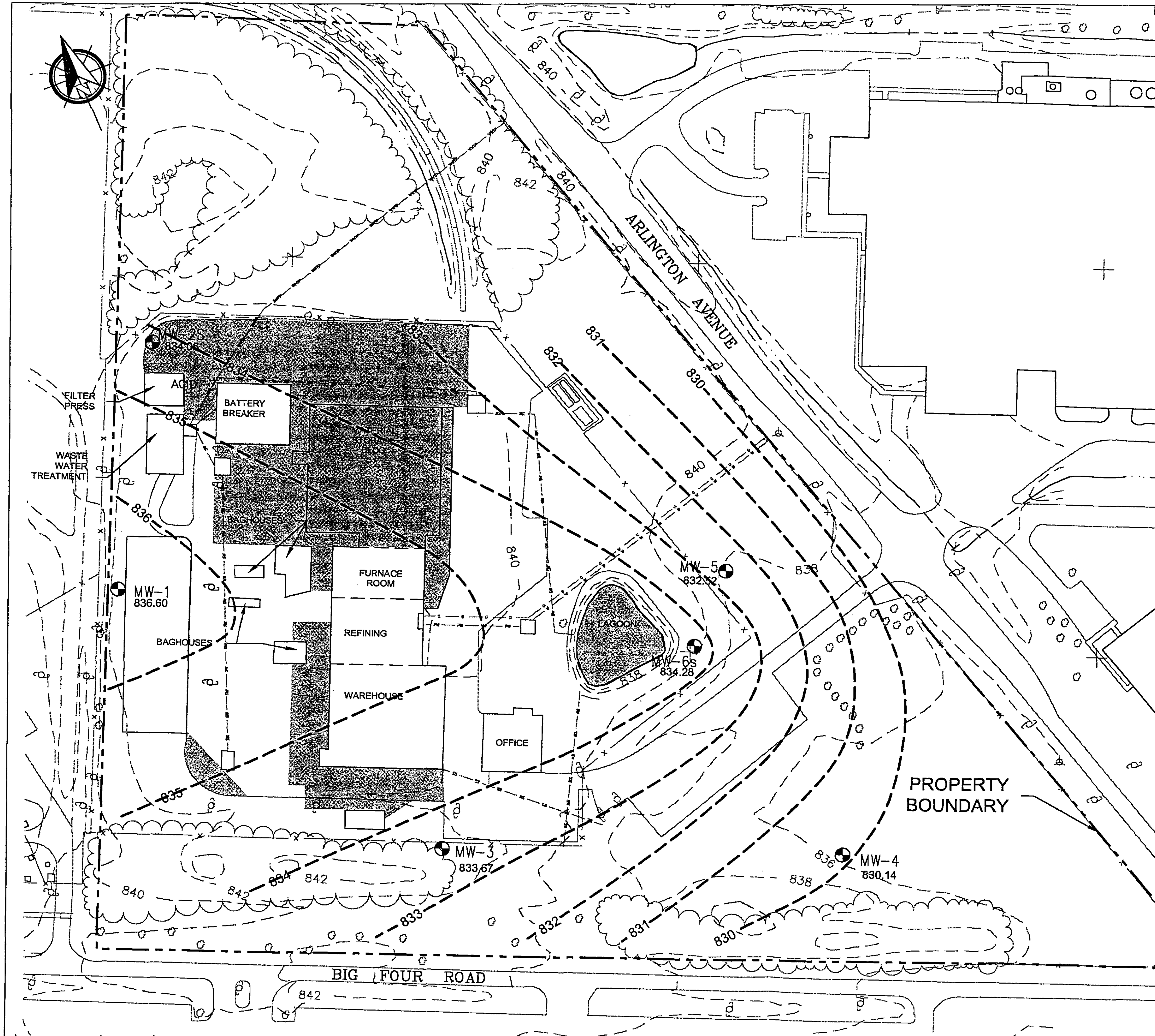
Scale: 1"=130'	
Originated By: B.M.L.	
Drawn By: V.E.N.	
Checked By:	
Project Mgr: P.G.S.	
Dwg No. 98478-06	
Issued:	

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-03

FIGURE: 5-4

J:\REFINED METALS\DRAWINGS\9847803\98478-06(CLOSURE)



LEGEND

SHALLOW MONITORING WELL-SURVEYED BY THE SCHNEIDER CORP., INDIANAPOLIS, IN

REFINED METALS CORPORATION
CLOSURE INVESTIGATION REPORT
BEECH GROVE, INDIANA

Scale: 1"=130'	POTENTIOMETRIC SURFACE MAP FOR SHALLOW GROUNDWATER 12/13/99
Originated By: B.M.L.	
Drawn By: V.E.N.	
Checked By:	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-07	Project No. 98-478-03
Issued:	FIGURE: 5-5

APPENDIX A
DATA VALIDATION REPORT FOR RFI SOIL, DUST AND SEDIMENT SAMPLES

DATA VALIDATION REPORT

OF

REMEDIAL FIELD INVESTIGATION SOIL, SEDIMENT, AND DUST SAMPLES
COLLECTED AUGUST 10 THROUGH SEPTEMBER 1, 1999, AND SEPTEMBER 20, 1999

FOR

ORGANIC AND INORGANIC PARAMETERS

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

Laboratory Case Number
35132-1, 2, 3, 7, 10, 11, 12, 14, 17, 18, 19, 22, 23, 24, and 25

PREPARED FOR:

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

PREPARED BY:

ADVANCED GEOSERVICES CORP.
CHADDS FORD, PENNSYLVANIA

DECEMBER 21, 1999

PROJECT NUMBER 98-478-03

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3.0	Inorganic Data Validation	4
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	3.2 Qualifications	4
4.0	Conclusion	10

TABLES

Volatiles and Semivolatiles Data Summary Table
Metals Data Summary Table

ATTACHMENTS

Volatiles Data Support Documentation
Semivolatiles Data Support Documentation
Metals Data Support Documentation

1.0 INTRODUCTION

Soil, sediment, and dust samples were collected at the Refined Metals Corporation (RMC) Site in Beech Grove, Indiana, between August 10 and September 1, 1999 for chemical analyses as part of the RMC Remedial Field Investigation (RFI). Additional soil samples were collected on September 20, 1999. The samples were analyzed for volatile and semivolatile organic compounds and Resource Conservation Recovery Act (RCRA) metals. Several field duplicates and equipment blanks were also collected and analyzed. Analyses of these samples were performed by TriMatrix Laboratories of Grand Rapids, Michigan. The sample results are reported under TriMatrix Case Numbers 35132-1, 2, 3, 7, 10, 11, 12, 14, 17, 18, 19, 22, 23, 24, and 25.

The samples were analyzed for the following parameters by the corresponding methodologies:

Analytical Parameter	Methodology
Volatile Organic Compounds	SW-846 Method 8260B
Semivolatile Organic Compounds	SW-846 Method 8270C
RCRA Metals	SW-846 Method 6020/7471

The data deliverables consisted of a Report of Analysis listing each sample and result, chain-of-custody records, copies of relevant notebook pages and instrument raw data, calibration information, laboratory blank analysis results, and quality control forms that show precision and accuracy data derived from the quality control samples.

Field duplicate samples can be identified by the "D" after the sample number. The duplicate samples correspond with the sample letter preceding the "D." For example, the sample RSB-29B has a corresponding field duplicate sample of RSB-29D.

2.0 ORGANIC DATA VALIDATION

All data generated by TriMatrix were reviewed by an Advanced GeoServices Corp. data validation specialist. Validation was performed for holding time compliance, GC/MS tuning criteria, laboratory method blank and field blank contamination, initial and continuing calibration accuracy, surrogate recoveries, internal standard area control limits, matrix spike/matrix spike duplicate (MS/MSD) recovery and precision, field duplicate precision, and detection limit applicability. Organic data were validated according to the "USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review" (February 1994) and "Region V Standard Operating Procedure for Validation of CLP Organic Data" (August 1993).

Validation was performed to verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. For criteria differences between the functional guidelines and the specific method, the specific method criteria prevailed. Qualifier codes were applied as required. The U qualifier code was applied to all sample results qualitatively questioned due to blank contamination. The U reflects either an adjusted detection limit due to blank contamination or the analyte was not detected at or above the associated detection limit. The J qualifier code was applied to all sample results which are considered quantitative estimates due to exceeding quality control criteria. The UJ qualifier code was applied to all results which were undetected but are estimated due to exceeding quality control criteria. Samples may have exceeded several quality control criteria, however, only one qualifier is applied to a result.

2.1.1 Volatile Organic Data

2.1.2 General

Soil samples collected from seven locations were analyzed for benzene, toluene, ethylbenzene, napthalene, and isopropylbenzene by SW-846 method 8260B. An associated equipment blank was analyzed for the same parameters as the samples. All holding times were within the EPA method requirements. Samples were received at the laboratory at 3°C. Initial calibrations were accurate. Internal standard areas were within control limits. Laboratory control sample recoveries were within acceptance criteria. MS/MSD recoveries were accurate.

2.1.3 Qualifications

Due to a- continuing calibration percent difference (%D) of greater than 20 for napthalene, sample EQB-1 (231638) detection limit is estimated (UJ).

Due to surrogate percent recoveries (%Rs) less than the lower acceptance limit but greater than 10%, the detection limits for sample RD-11A (231363) are estimated (UJ) for all compounds.

2.1.4 Comments

Napthalene was present in method blank BLK0913A at 11 ug/l. However, because there were no positive results for napthalene in the samples, no qualifiers were applied.

2.2 Semivolatile Organic Data

2.2.1 General

Soil samples collected from seven locations were analyzed for fluorene and phenanthrene by SW-846 method 8270C. An associated equipment blank was analyzed for the same parameters as the samples. All holding times were within the EPA method requirements. Samples were received at the laboratory at 3°C. Initial and continuing calibrations were accurate. The method blank and equipment blank were free of contamination. Internal standard areas were within control limits. Laboratory control sample recoveries were within acceptance criteria. MS/MSD recoveries were accurate.

2.2.2 Qualifications

No qualifications are applied to the semivolatile organic data. All results are acceptable as reported.

3.0 INORGANIC DATA VALIDATION

All data generated by TriMatrix were reviewed by an Advanced GeoServices Corp. data validation specialist. Validation was performed for holding time compliance, laboratory method blank and field blank contamination, initial and continuing calibration accuracy, MS/MSD recovery and precision, field duplicate precision, and detection limit applicability. Inorganic data were validated according to the "USEPA CLP National Functional Guidelines for Inorganic Data Review" (February 1994) and "Region V Standard Operating Procedures for Validation of CLP Inorganic Data" (September 1993).

Validation was performed to verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. For criteria differences between the functional guidelines and the specific method, the specific method criteria prevailed. Qualifier codes were applied as required. The U qualifier code was applied to all sample results qualitatively questioned due to blank contamination. The U also denotes the analyte was not detected at or above the associated instrument detection limit. The J qualifier code was applied to all sample results which are considered quantitative estimates due to exceeding quality control criteria. The UJ qualifier code was applied to all results which were undetected but are estimated due to exceeding quality control criteria. Some samples exceeded more than one quality control criteria for a particular parameter. In these instances, only one qualifier code was applied and the sample was only noted once in the qualifier section.

3.1. General

Four floor dust samples (CFD), 22 sediment samples (RSED), 188 soil samples (RSB), 25 field duplicate samples, and 25 equipment blanks (EQ) were collected and analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and antimony by SW-846 method 6020, 7470 and 7471. All holding times were within the EPA method requirements. Initial and continuing calibrations were accurate.

3.2 Qualifications

According to Region V criteria, when applying qualification based on blank contamination, results which are greater than the instrument detection limit (IDL) but less than five times the Contract Required Detection Limit (CRDL) are qualified using the following criteria: results less than five times the blank concentration are qualified with the U qualifier code and results greater than five times the blank concentration are qualified with the J qualifier code.

Due to the presence of arsenic in an associated method blank, the following sample arsenic results are qualitatively questioned and designated with the U qualifier code to reflect an elevated detection limit:

RSB-11B (229440)	RSB-13B (229437)	RSB-16B (229434)

Due to the presence of chromium in associated method blanks, the following chromium sample results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

RSB-14A (230352)	RSB-14B (230353)	RSB-17B (230351)
RSB-18A (230348)	RSB-18B (230349)	RSB-22D (230347)
RSB-25A (230339)	RSB-25B (230340)	RSB-26A (230337)
RSB-26B (230338)	RSB-32A (230331)	RSB-32B (230332)
RSB-33A (230334)	RSB-33B (230335)	RSB-52A (230355)
RSB-52B (230356)	RSB-52C (230357)	RSB-53C (230360)
RSB-56A (230342)	RSB-56C (230344)	RSB-84C (230330)

Due to the presence of selenium in associated method blanks, the following selenium sample results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

RSB-23A (229219)	RSB-23B (229220)	RSB-45A (229221)
RSB-45B (229222)	RSB-45D (229223)	RSB-46B (229225)
RSB-21B (229432)	RSB-16A (229433)	RSB-16B (229434)
RSB-13A (229436)	RSB-13B (229437)	RSB-11A (229439)
RSB-11B (229440)	RSB-10A (229441)	RSB-10B (229442)
RSB-7A (229443)	RSB-7B (229444)	RSB-7D (229445)
RSB-AA (229446)	RSB-AB (229447)	RSB-BA (229448)
RSB-BB (229449)	RSB-5A (229450)	RSB-5B (229451)
RSB-58C (229231)	RSB-38A (229235)	RSB-38B (229236)
RSB-16D (229435)		

Due to the presence of lead in associated method blanks and/or equipment blanks, the following lead sample results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

RSB-72A (230209)	RSB-72B (230210)	RSB-72C (230211)

RSB-76A (229930)	RSB-80B (230272)	RSB-80C (230273)
RSB-81B (230245)	RSB-81C (230270)	RSB-83A (230279)
RSB-83B (230280)		

Several samples exceeded the criteria for duplicate injection precision (less than or equal to 20% relative standard deviation (RSD)) for selenium. The following sample results are estimated (J):

RSB-37B (230194)	RSB-44B (230197)	RSB-43A (230198)
RSB-42B (230202)	RSB-72C (230211)	RSB-73B (230205)
RSB-51A (230233)	RSED-4A (230383)	RSB-52A (230355)
RSB-53C (230360)	RSB-57C (230364)	RSB-65A (230186)
RSB-77C (230181)	RSB-68B (230191)	

Due to duplicate injection precision of greater than 20% RSD, the silver result is estimated (J) for sample RSED-5A (230385).

Due to mercury MS/MSD percent recoveries outside the upper acceptance criteria (75-125), detected mercury results are estimated (J) for the following samples:

RSB-14A (230352)	RSB-14B (230353)	RSB-57A (230362)
RSB-57B (230363)	RSB-55A (230366)	RSB-55B (230367)
RSB-55C (230368)	RSB-55D (230369)	RSB-54A (230370)
RSB-54B (230371)	RSB-33A (230334)	RSB-26A (230337)
RSB-26B (230338)	RSB-25A (230339)	RSB-25B (230340)
RSED-3B (230382)		

Due to barium and selenium MS/MSD percent recoveries outside the lower acceptance criteria, the following sample results and detection limits are estimated (J, UJ):

RSB-70A (232808)	RSB-70B (232809)	RSB-70C (232810)
RSB-64A (232811)	RSB-64B (232812)	RSB-69A (232813)
RSB-69B (232814)	RSB-69C (232815)	RSB-63A (232817)
RSB-63B (232818)	RSB-63D (232819)	

Due to cadmium and lead MS/MSD %Rs outside the acceptance limits, the following sample cadmium and lead results are estimated (J):

RSED-7A (230596)	RSED-7B (230597)	RSED-6A (230598)
RSED-11A (230552)	RSED-12A (230553)	

Due to lead MS/MSD %Rs outside the lower acceptance limits, the following sample lead results are estimated (J):

RSB-79A (230276)	RSB-79B (230277)	RSB-79C (230278)
RSB-85A (230283)	RSB-85B (230284)	RSB-85C (230285)
RSB-85D (230286)	RSB-82A (230287)	RSB-82B (230288)
RSB-82C (230289)	RSB-84A (230290)	RSB-80A (230271)
RSB-83C (230281)	RSB-80D (230274)	

Due to arsenic and selenium MS/MSD poor accuracy and precision, the following samples are estimated (J, UJ):

RSB-84C (230330)	RSB-32A (230331)	RSB-32B (230332)
RSB-33A (230334)	RSB-33B (230335)	RSB-33D (230336)
RSB-26A (230337)	RSB-26B (230338)	

Due to barium, lead, and silver MS/MSD %Rs outside acceptance criteria, sample RSB-84B (230291) results are estimated (J, UJ).

Due to arsenic, barium, lead, and selenium MS/MSD duplicate precision outside the lower acceptance criteria, the following sample results and detection limits are estimated (J, UJ):

RSB-15A (229921)	RSB-15B (229922)	RSB-19A (229923)
RSB-19B (229924)	RSB-27A (229925)	RSB-27B (229926)
RSB-34A (229927)	RSB-34B (229928)	RSB-76A (229930)
RSB-76B (229931)	RSB-76C (229932)	RSB-76D (229933)
RSB-74A (229934)	RSB-74B (229935)	RSB-74C (229936)
RSB-75A (229938)	RSB-75B (229939)	RSB-75D (229940)
RSB-75C (229941)		

The silver results for the following samples are estimated due to a Laboratory Control Sample (LCS) %R outside the acceptance limits (80 to 120%R). The LCS %R is 79.

RSB-25A (230339)	RSB-25B (230340)	RSB-56A (230342)
RSB-56B (230343)	RSB-56C (230344)	RSB-22A (230345)
RSB-22B (230346)	RSB-22D (230347)	RSB-18A (230348)
RSB-18B (230349)	RSB-17A (230350)	RSB-17B (230351)
RSB-14A (230352)	RSB-14B (230353)	RSB-52A (230355)
RSB-52B (230356)	RSB-52C (230357)	RSB-53A (230358)
RSB-53B (230359)	RSB-53C (230360)	

Field duplicate samples were evaluated based on duplicate precision. A control limit of ± 40% was used for original and duplicate sample values greater than or equal to 5 times the CRDL. A control limit of ± 2 times the CRDL was used if either the sample or duplicate result was less than the CRDL.

The following sample lead results are estimated (J) due to poor field duplicate precison:

CFD-3 (229240)	CFD-13 (229241)	CFD-1 (229238)
CFD-2 (229239)	RSB-77A (230179)	RSB-77B (230180)
RSB-77C (230181)	RSB-77D (230182)	RSB-66A (230184)
RSB-65A (230186)	RSB-65B (230187)	RSB-66B (230185)
RSB-67A (230188)	RSB-67B (230189)	RSB-68A (230190)
RSB-68B (230191)		

The following sample arsenic results are estimated (J) due to poor field duplicate precison:

RSB-45B (229222)	RSB-45D (229223)	RSB-45A (229221)
RSB-23A (229219)	RSB-23B (229220)	RSB-46A (229224)
RSB-46B (229225)	RSB-31A (229226)	RSB-31B (229227)
RSB-63B (232818)	RSB-63D (232819)	RSB-36A (232817)
RSB-70A (232808)	RSB-70B (232809)	RSB-70C (232810)
RSB-64A (232811)	RSB-64B (232812)	RSB-69A (232813)
RSB-69B (232814)	RSB-69C (232815)	

The following sample chromium results are estimated (J) due to poor field duplicate precison:

RSB-33D (230336)	RSB-22A (230345)	RSB-22B (230346)
RSB-56B (230343)	RSB-17A (230350)	RSB-49A (230236)
RSB-49B (230337)	RSB-49C (230238)	RSB-49D (230239)
RSB-74A (229934)	RSB-74B (229935)	RSB-78A (230241)
RSB-78B (230242)	RSB-78C (230243)	RSB-81A (230244)
RSB-81B (230245)	RSB-81C (230270)	RSB-76C (229932)
RSB-76D (229933)	RSB-76A (229930)	RSB-74C (229936)
RSB-76B (229931)		

The following sample selenium results are estimated (J) due to poor field duplicate precison:

RSB-49A (230236)	RSB-49B (230337)	RSB-49C (230238)
RSB-49D (230239)	RSB-78A (230241)	RSB-78B (230242)
RSB-78C (230243)	RSB-81A (230244)	RSB-81B (230245)
RSB-81C (230270)		

Due to arsenic, barium, and chromium poor field duplicate precision, the following sample results are qualified as estimated (J):

RSB-80A (230271)	RSB-80B (230272)	RSB-80C (230273)
RSB-80D (230274)	RSB-79A (230276)	RSB-79B (230277)
RSB-79C (230278)	RSB-83A (230279)	RSB-83B (230280)
RSB-83C (230281)		

4.0 CONCLUSION

This data validation has identified a continuing calibration %D and a surrogate recovery accuracy as reasons for qualifying the volatile organic data. Additionally, this data validation has identified method and equipment blank contamination, duplicate injection precision, MS/MSD precision and accuracy, LCS accuracy, and field duplicate precision as reasons for qualifying the inorganic data. All other data are acceptable as reported by the laboratory. All data requiring qualification have been addressed in this review and are appropriately qualified on the data summary tables. To confidently use any of the analytical results, the data user should understand the qualifications and limitations stated in this report.

QUALIFIER CODES

U - Denotes the compound analyte is not present at or above the associated value.

J - Denotes an estimated value.

UJ - Denotes an undetected result that is estimated due to exceeding quality control criteria.

BEECH GROVE, IN
ORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-24
Sample Date(s)	9/1/1999	Method	EPA Methods 8260B, 8270C

Sample Location	RD-10A			RD-10B			RD-11A			RD-11B		
Lab ID	231361			231362			231363			231365		
Matrix	Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	9/1/1999			9/1/1999			9/1/1999			9/1/1999		
Comments												
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Benzene		U	0.054		U	0.055		UJ	0.054		U	0.053
Ethylbenzene		U	0.054		U	0.055		UJ	0.054		U	0.053
Fluorene		U	0.33		U	0.33		UJ	0.33		U	0.33
Isopropylbenzene		U	0.054		U	0.055		UJ	0.054		U	0.053
Napthalene		U	0.27		U	0.27		UJ	0.27		U	0.26
Phenanthrene		U	0.33		U	0.33		UJ	0.33		U	0.33
Toluene		U	0.054		U	0.055		UJ	0.054		U	0.053

Sample Location	RD-12A			RD-12B			RD-13A			EQB-1		
Lab ID	231366			231367			231364			231368		
Matrix	Soil			Soil			Soil			Aqueous		
Units	mg/kg			mg/kg			mg/kg			ug/L		
Sample Date	9/1/1999			9/1/1999			9/1/1999			9/1/1999		
Comments												
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Benzene		U	0.053		U	0.053		U	0.053		U	1.0
Ethylbenzene		U	0.053		U	0.053		U	0.053		U	1.0
Fluorene		U	0.33		U	0.33		U	0.33		U	5.0
Isopropylbenzene		U	0.053		U	0.053		U	0.053		U	1.0
Napthalene		U	0.26		U	0.26		U	0.26		UJ	5.0
Phenanthrene		U	0.33		U	0.33		U	0.33		U	5.0
Toluene		U	0.053		U	0.053		U	0.053		U	1.0

DL -Detection limit.
Q - Qualifier.
U - The compound was not detected at or above the associated quantitation limit.
UJ - Denotes an estimated quantitation limit.

QA Scientist Megan N. Ritchie Date 10/20/99

BEECH GROVE RFI
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	CFD-1			CFD-2			CFD-3			CFD-13			RSB-1A			RSB-1B			RSB-2A			RSB-2B			RSB-2D			RSB-3A		
Lab ID	229238			229239			229240			229241			230212			230213			230215			230216			230217			230218		
Matrix	Dust			Dust			Dust			Dust			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/12/99			8/12/99			8/12/99			8/12/99			8/22/99			8/22/99			8/22/99			8/22/99			8/22/99			8/22/99		
Comments										FD of CFD-3															FD of RSB-2B					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	NA			NA			NA			NA			11		1.0	6.2		1.0	14		1.0	6.6		1.0	7.4		1.0	9.1		1.0
Barium	NA			NA			NA			NA			73		1.0	91		1.0	75		1.0	79		1.0	72		1.0	142		1.0
Cadmium	436		0.5	357		0.5	547		0.5	474		0.5	28		0.50	0.88		0.50	4.5		0.50	0.99		0.50	1.1		0.5	2.8		0.50
Chromium	NA			NA			NA			NA			15		1.0	17		1.0	15		1.0	16		1.0	14		1.0	19		1.0
Lead	497000	J	0.6	342000	J	0.6	707000	J	0.6	377000	J	0.6	873		0.60	215		0.60	1100		0.60	202		0.60	264		0.6	632		0.60
Mercury	NA			NA			NA			NA			0.12		0.10		U	0.10	0.11		0.10		U	0.10		U	0.1		U	0.10
Selenium	NA			NA			NA			NA			1.3		0.50	1.3		0.50	1.2		0.50	1.1		0.50	0.74		0.5	1.8		0.50
Silver	NA			NA			NA			NA				U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-3B			RSB-4A			RSB-4B			RSB-5A			RSB-5B			RSB-6A			RSB-6B			RSB-7A			RSB-7B			RSB-7D		
Lab ID	230219			230220			230221			229450			229451			230222			230223			229443			229444			229445		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			ug/L			ug/L		
Sample Date	8/22/99			8/22/99			8/22/99			8/16/99			8/16/99			8/22/09			8/22/09			8/16/99			8/16/99			8/16/99		
Comments																												FD of RSB-7B		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	7.0		1.0	22		1.0	9.8		1.0	10		1.0	7.5		1.0	22		1.0	9.0		1.0	14		1.0	6.8		1.0	6.8		1.0
Barium	97		1.0	83		1.0	86		1.0	72		1.0	77		1.0	47		1.0	48		1.0	58		1.0	61		1.0	57		1.0
Cadmium	2.0		0.50	17		0.50	4.4		0.50	3.2		0.50	1.1		0.50	7.3		0.50	1.4		0.50	3.3		0.50	0.80		0.5	0.95		0.50
Chromium	16		1.0	16		1.0	14		1.0	13		1.0	13		1.0	11		1.0	10		1.0	12		1.0	12		1.0	11		1.0
Lead	593		0.60	2360		0.60	686		0.60	985		0.60	366		0.60	1880		0.60	289		0.60	1150		0.60	232		0.6	283		0.60
Mercury		U	0.10	0.12		0.10		U	0.10		U	0.10		U	0.10	0.12		0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	1.6		0.50	1.9		0.50	1.3		0.50	0.92	U	0.50	0.80	U	0.50	1.4		0.50	1.4		0.50	1.1	U	0.50	1.2	U	0.5	1.2	U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.
CFD - Floor dust samples.

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QA Scientist Dennis McGuire Date 12/21/99

BEECH GR RFI
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-8A			RSB-8B			RSB-9A			RSB-9B			RSB-9D			RSB-10A			RSB-10B			RSB-11A			RSB-11B			RSB-12A		
Lab ID	230224			230225			230227			230228			230229			229441			229442			229439			229440			229232		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/22/99			8/22/99			8/22/99			8/22/99			8/22/99			8/16/99			8/16/99			8/16/99			8/16/99			8/11/99		
Comments													FD of RSB-9B																	
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	23		1.0	9.1		1.0	96		1.0	27		1.0	28		1.0	14		1.0	6.6		1.0	13		1.0	5.1	U	1.0	95		1.0
Barium	32		1.0	34		1.0	73		1.0	72		1.0	78		1.0	59		1.0	61		1.0	81		1.0	53		1.0	122		1.0
Cadmium	6.8		0.50	1.4		0.50	39		0.50	9.7		0.50	11		0.50	3.9		0.50	0.56		0.50	12		0.50		U	0.5	6.3		0.50
Chromium	7.5		1.0	8.4		1.0	15		1.0	11		1.0	12		1.0	10		1.0	13		1.0	11		1.0	10		1.0	17		1.0
Lead	1050		0.60	321		0.60	14500		0.60	3800		0.60	3080		0.60	1850		0.60	241		0.60	641		0.60	101		0.6	11100		0.60
Mercury		U	0.10		U	0.10	0.31		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1	0.11		0.10
Selenium	1.3		0.50	0.87		0.50	8.7		0.50	1.9		0.50	2.2		0.50	1.8	U	0.50	0.79	U	0.50	0.80	U	0.50	0.51	U	0.5	5.6		0.50
Silver		U	0.20		U	0.20	0.28		0.20		U	0.20	0.25		0.20	0.24		0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-12B			RSB-12D			RSB-13A			RSB-13B			RSB-14A			RSB-14B			RSB-15A			RSB-15B			RSB-16A			RSB-16B		
Lab ID	229233			229234			229436			229437			230352			230353			229921			229922			229433			229434		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/11/99			8/11/99			8/16/99			8/16/99			8/24/99			8/24/99			8/19/99			8/19/99			8/16/99			8/16/99		
Comments				FD of RSB-12B																										
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	125		1.0	128		1.0	11		1.0	5.0	U	1.0	24		1.0	15		1.0	22	J	1.0	10	J	1.0	13		1.0	5.6	U	1.0
Barium	122		1.0	110		1.0	54		1.0	61		1.0	120		1.0	76		1.0	50	J	1.0	53	J	1.0	51		1.0	47		1.0
Cadmium	8.4		0.50	9.0		0.50	2.7		0.50	0.52		0.50	15		0.50	3.6		0.50	23		0.50	1.9		0.50	2.8		0.5	0.57		0.50
Chromium	16		1.0	14		1.0	8.8		1.0	8.8		1.0	15	U	1.0	11	U	1.0	10		1.0	10		1.0	10		1.0	10		1.0
Lead	17500		0.60	15200		0.60	682		0.60	96		0.60	8100		0.60	8480		0.60	1070	J	0.60	211	J	0.60	661		0.6	95		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	0.11	J	0.10	0.13	J	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	8.0		0.50	6.2		0.50	0.75	U	0.50	0.65	U	0.50	1.9		0.50	1.5		0.50	1.1	J	0.50	80	J	0.50	0.71	U	0.5	0.59	U	0.50
Silver	0.22		0.20	0.23		0.20		U	0.20		U	0.20		UJ	0.20		UJ	0.20		U	0.20		U	0.20	0.84		0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Diane Mhre Date 12/21/99

BEECH GROV[illegible]
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-16D			RSB-17A			RSB-17B			RSB-18A			RSB-18B		
Lab ID	229435			230350			230351			230348			230349		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/16/99			8/24/99			8/24/99			8/24/99			8/24/99		
Comments	FD of RSB-16B														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	6.5		1.0	10		1.0	9.7		1.0	7.8		1.0	6.3		1.0
Barium	50		1.0	215		1.0	133		1.0	47		1.0	39		1.0
Cadmium	0.63		0.50	188		0.50	12		0.50	1.7		0.50		U	0.50
Chromium	13		1.0	23	J	1.0	16	U	1.0	8.1	U	1.0	8.2	U	1.0
Lead	96		0.60	530		0.60	21		0.60	526		0.60	50		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.52	U	0.50	2.5		0.50	0.98		0.50	0.71		0.50	0.60		0.50
Silver		U	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20

Sample Location	RSB-19A			RSB-19B			RSB-20A			RSB-20B			RSB-21A		
Lab ID	229923			229924			228728			228729			229431		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	ug/L			ug/L			mg/kg			mg/kg			mg/kg		
Sample Date	8/19/99			8/19/99			8/10/99			8/10/99			8/16/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	7.0	J	1.0	6.8	J	1.0	14		1.0	10		1.0	8.3		1.0
Barium	43	J	1.0	49	J	1.0	83		1.0	85		1.0	64		1.0
Cadmium	0.64		0.50	0.69		0.50	5.0		0.50	1.2		0.5	2.7		0.50
Chromium	8.7		1.0	8.1		1.0	15		1.0	16		1.0	8.5		1.0
Lead	11	J	0.60	13	J	0.60	593		0.60	97		0.6	497		0.60
Mercury		U	0.10		U	0.10	0.13		0.10		U	0.1		U	0.10
Selenium	1.3	J	0.50	1.2	J	0.50	1.2		0.50	1.0		0.5		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-21B			RSB-22A			RSB-22B			RSB-22D			RSB-23A		
Lab ID	229432			230345			230346			230347			229219		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/16/99			8/24/99			8/24/99			8/24/99			8/11/99		
Comments										FD of RSB-22B					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	7.2		1.0	21		1.0	10		1.0	12		1.0	18	J	1.0
Barium	52		1.0	187		1.0	88		1.0	90		1.0	78		1.0
Cadmium	0.55		0.50	6.9		0.50	2.7		0.50	2.9		0.50	3.5		0.50
Chromium	13		1.0	25	J	1.0	25	J	1.0	15	U	1.0	19		1.0
Lead	105		0.60	478		0.60	237		0.60	247		0.60	987		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	0.12		0.10
Selenium	0.74	U	0.50	1.3		0.50	0.55		0.50	0.94		0.50	1.1	U	0.50
Silver		U	0.20		UJ	0.20		UJ	0.20		UJ	0.20		U	0.20

Sample Location	RSB-23B			RSB-24A			RSB-24B			RSB-25A			RSB-25B		
Lab ID	229220			228743			228744			230339			230340		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/11/99			8/10/99			8/10/99			8/24/99			8/24/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	2.6	J	1.0	20		1.0	6.5		1.0	867		1.0	104		1.0
Barium	70		1.0	55		1.0	63		1.0	217		1.0	145		1.0
Cadmium	0.79		0.50	8.7		0.50	1.2		0.50	103		0.5	28		0.50
Chromium	12		1.0	9.8		1.0	11		1.0	12	U	1.0	21	U	1.0
Lead	157		0.60	1980		0.60	288		0.60	83500		0.6	7930		0.60
Mercury		U	0.10		U	0.10		U	0.10	3.0	J	0.1	0.49	J	0.10
Selenium	0.92	U	0.50	0.93		0.50	0.78		0.50	50	J	0.5	6.0	J	0.50
Silver		U	0.20		U	0.20		U	0.20	1.5	J	0.2		UJ	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist [signature] Date 12/21/99

BEECH GROVE RFI
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999
Laboratory	TriMatrix Laboratories
Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-26A			RSB-26B			RSB-27A			RSB-27B			RSB-28A			RSB-28B			RSB-29A			RSB-29B			RSB-29D			RSB-30A		
Lab ID	230337			230338			229925			229926			228723			228724			228725			228726			228727			228741		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/24/99			8/24/99			8/19/99			8/19/99			8/10/99			8/10/99			8/10/99			8/10/99			8/10/99			8/10/99		
Comments																									FD of RSB-29B					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	175	J	1.0	184	J	1.0	8.1	J	1.0	6.5	J	1.0	56		1.0	16		1.0	23		1.0	11		1.0	12		1.0	15		1.0
Barium	97		1.0	114		1.0	39	J	1.0	39	J	1.0	62		1.0	85		1.0	67		1.0	97		1.0	99		1.0	125		1.0
Cadmium	17		0.50	10		0.50		U	0.50		U	0.50	14		0.50	3.4		0.50	8.5		0.50	2.5		0.50	1.9		0.5	3.3		0.50
Chromium	15	U	1.0	21	U	1.0	8.4		1.0	8.6		1.0	14		1.0	15		1.0	13		1.0	17		1.0	21		1.0	16		1.0
Lead	9670		0.60	8130		0.60	14	J	0.60	14	J	0.60	3140		0.60	478		0.60	1480		0.60	350		0.60	278		0.6	887		0.60
Mercury	0.36	J	0.10	0.36	J	0.10		U	0.10		U	0.10	0.33		0.10		U	0.10	0.26		0.10		U	0.10		U	0.1		U	0.10
Selenium	6.4	J	0.50	4.6	J	0.50	1.3	J	0.50	1.3	J	0.50	2.0		0.50	1.1		0.50	0.94		0.50	0.86		0.50	0.82		0.5	1.3		0.50
Silver		U	0.20	0.23		0.20		U	0.20		U	0.20	0.24		0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-30B			RSB-31A			RSB-31B			RSB-32A			RSB-32B			RSB-33A			RSB-33B			RSB-33D			RSB-34A			RSB-34B		
Lab ID	228742			229226			229227			230331			230332			230334			230335			230336			229927			229928		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/10/99			8/11/99			8/11/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/19/99			8/19/99		
Comments																						FD of RSB-33B								
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	7.4		1.0	202	J	1.0	232	J	1.0	13	J	1.0	7.7	J	1.0	56	J	1.0	10	J	1.0	12	J	1.0	6.5	J	1.0	6.3	J	1.0
Barium	110		1.0	84		1.0	88		1.0	107		1.0	83		1.0	108		1.0	163		1.0	146		1.0	34	J	1.0	28	J	1.0
Cadmium	0.64		0.50	38		0.50	50		0.50	5.0		0.50	1.8		0.50	3.8		0.50	0.54		0.50		U	0.50		U	0.5		U	0.50
Chromium	17		1.0	15		1.0	12		1.0	18	U	1.0	13	U	1.0	20	U	1.0	18	U	1.0	99	J	1.0	6.9		1.0	6.7		1.0
Lead	127		0.60	23700		0.60	27400		0.60	841		0.60	531		0.60	2200		0.60	22		0.60	21		0.60	19	J	0.6	19	J	0.60
Mercury		U	0.10	0.48		0.10	0.63		0.10		U	0.10		U	0.10	0.15	J	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	1.5		0.50	8.7		0.50	9.6		0.50	1.2	J	0.50	0.75	J	0.50	1.9	J	0.50	1.8	J	0.50	2.4	J	0.50		UJ	0.5	1.3	J	0.50
Silver		U	0.20	0.34		0.20	0.26		0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Diane Mc[illegible] Date 12/21/99

BEECH GROV
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove		Laboratory	TriMatrix Laboratories
Project Number	98-478-03		Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999		Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-35A			RSB-35B			RSB-36A			RSB-36B			RSB-36D		
Lab ID	230373			230374			228737			228738			228739		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/24/99			8/24/99			8/10/99			8/10/99			8/10/99		
Comments													FD of RSB-36B		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	10		1.0	6.4		1.0	9.2		1.0	5.7		1.0	6.0		1.0
Barium	106		1.0	67		1.0	93		1.0	96		1.0	94		1.0
Cadmium		U	0.50		U	0.50	1.9		0.50	0.67		0.50	0.55		0.50
Chromium	18		1.0	15		1.0	14		1.0	18		1.0	15		1.0
Lead	43		0.60	23		0.60	216		0.60	55		0.60	39		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.89		0.50	0.58		0.50	1.1		0.50	1.1		0.50	0.97		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	RSB-37A			RSB-37B			RSB-37D			RSB-38A			RSB-38B		
Lab ID	230193			230194			230195			229235			229236		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/21/99			8/21/99			8/21/99			8/13/99			8/13/99		
Comments							FD of RSB-37B								
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	17		1.0	13		1.0	12		1.0	14		1.0	7.2		1.0
Barium	85		1.0	87		1.0	64		1.0	70		1.0	66		1.0
Cadmium	6.5		0.50	4.2		0.50	3.4		0.50	4.3		0.5	1.3		0.50
Chromium	13		1.0	10		1.0	13		1.0	9.2		1.0	9.8		1.0
Lead	679		0.60	594		0.60	570		0.60	2000		0.6	440		0.60
Mercury		U	0.10		U	0.10		U	0.10	0.13		0.1		U	0.10
Selenium	1.2		0.50	1.7	J	0.50	1.1		0.50	0.99	U	0.5	0.65	U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-39A			RSB-39B			RSB-40A			RSB-40B			RSB-41A		
Lab ID	228730			228731			228733			228734			228735		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/10/99			8/10/99			8/10/99			8/10/99			8/10/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	10		1.0	7.6		1.0	19		1.0	7.0		1.0	10		1.0
Barium	119		1.0	73		1.0	67		1.0	69		1.0	64		1.0
Cadmium	1.1		0.50	0.63		0.50	4.1		0.50	0.99		0.50	1.5		0.50
Chromium	19		1.0	14		1.0	12		1.0	10		1.0	13		1.0
Lead	227		0.60	81		0.60	901		0.60	161		0.60	341		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.77		0.50	1.5		0.50	1.1		0.50	0.69		0.50	1.4		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	RSB-41B			RSB-42A			RSB-42B			RSB-43A			RSB-43B		
Lab ID	228736			230200			230202			230198			230199		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/10/99			8/21/99			8/21/99			8/21/99			8/21/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	5.7		1.0	15		1.0	7.3		1.0	20		1.0	11		1.0
Barium	68		1.0	58		1.0	54		1.0	92		1.0	72		1.0
Cadmium		U	0.50	3.2		0.50	0.91		0.50	5.3		0.5	0.90		0.50
Chromium	14		1.0	9.4		1.0	11		1.0	15		1.0	16		1.0
Lead	82		0.60	834		0.60	214		0.60	1130		0.6	230		0.60
Mercury		U	0.10		U	0.10		U	0.10	0.13		0.1		U	0.10
Selenium	0.84		0.50	0.68		0.50	1.0	J	0.50	1.3	J	0.5	0.81		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

QA Scientist Dan Mu Date 12/21/99

BEECH GRO FI
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-44A			RSB-44B			RSB-45A			RSB-45B			RSB-45D			RSB-46A			RSB-46B			RSB-49A			RSB-49B			RSB-49C		
Lab ID	230196			230197			229221			229222			229223			229224			229225			230236			230237			230238		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/21/99			8/21/99			8/11/99			8/11/99			8/11/99			8/11/99			8/11/99			8/22/99			8/22/99			8/22/99		
Comments													FD of RSB-45B																	
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	9.5		1.0	8.9		1.0	6.1	J	1.0	10	J	1.0	4.1	J	1.0	3.9	J	1.0	5.4	J	1.0	20		1.0	1.4		1.0		U	1.0
Barium	57		1.0	75		1.0	33		1.0	43		1.0	38		1.0	42		1.0	50		1.0	131		1.0	154		1.0	85		1.0
Cadmium	1.1		0.50		U	0.50	1.9		0.50	1.1		0.50	0.91		0.50	1.1		0.50	0.75		0.50	3.9		0.50	2.4		0.5	0.64		0.50
Chromium	14		1.0	20		1.0	7.4		1.0	11		1.0	7.6		1.0	5.7		1.0	10		1.0	17	J	1.0	17	J	1.0	5.6	J	1.0
Lead	369		0.60	53		0.60	487		0.60	234		0.60	172		0.60	385		0.60	216		0.60	1060		0.60	663		0.6	186		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	0.88		0.50	0.85	J	0.50	0.64	U	0.50	0.72	U	0.50	0.56	U	0.50		U	0.50	0.89	U	0.50	1.0	J	0.50	0.75	J	0.5	0.53	J	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-49D			RSB-50A			RSB-50B			RSB-50C			RSB-51A			RSB-51B			RSB-51C			RSB-52A			RSB-52B			RSB-52C		
Lab ID	230239			230230			230231			230232			230233			230234			230235			230355			230356			230357		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/22/99			8/22/99			8/22/99			8/22/99			8/22/99			8/22/99			8/22/99			8/24/99			8/24/99			8/24/99		
Comments	FD of RSB-49C																													
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	6.3		1.0	38		1.0	9.0		1.0	12		1.0	169		1.0	77		1.0	43		1.0	6.6		1.0	5.9		1.0	6.9		1.0
Barium	79		1.0	48		1.0	51		1.0	95		1.0	83		1.0	89		1.0	161		1.0	57		1.0	79		1.0	80		1.0
Cadmium	0.60		0.50	14		0.50	3.5		0.50	2.3		0.50	45		0.50	36		0.50	11		0.50		U	0.50	0.51		0.5		U	0.50
Chromium	11	J	1.0	6.7		1.0	7.0		1.0	16		1.0	15		1.0	13		1.0	17		1.0	14	U	1.0	14	U	1.0	15	U	1.0
Lead	182		0.60	5470		0.60	888		0.60	873		0.60	12600		0.60	4430		0.60	3300		0.60	25		0.60	77		0.6	67		0.60
Mercury		U	0.10	0.21		0.10		U	0.10		U	0.10	0.17		0.10	0.12		0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	1.8	J	0.50	1.4		0.50	0.86		0.50	1.1		0.50	7.2	J	0.50	3.1		0.50	1.8		0.50	0.63	J	0.50	0.84		0.5	0.84		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20	0.23		0.20	0.23		0.20		U	0.20		UJ	0.20		UJ	0.2		UJ	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Dana McMahon Date 12/21/99

BEECH GROVE
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove		Laboratory	TriMatrix Laboratories
Project Number	98-478-03		Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999		Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB53A			RSB-53B			RSB-53D			RSB-53C			RSB-54A			RSB-54B			RSB-54C			RSB-55A			RSB-55B			RSB-55D		
Lab ID	230358			230359			230361			230360			230370			230371			230372			230366			230367			230369		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99		
Comments							FD of RSB-53B																					FD of RSB-55B		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	8.2		1.0	8.3		1.0	9.2		1.0	6.9		1.0	107		1.0	94		1.0	3.4		1.0	323		1.0	359		1.0	349		1.0
Barium	134		1.0	176		1.0	137		1.0	53		1.0	101		1.0	90		1.0	65		1.0	97		1.0	121		1.0	92		1.0
Cadmium		U	0.50	0.58		0.50	0.45		0.50		U	0.50	29		0.50	22		0.50	0.51		0.50	38		0.50	52		0.5	52		0.50
Chromium	24		1.0	23		1.0	27		1.0	10	U	1.0	12		1.0	12		1.0	9.5		1.0	14		1.0	12		1.0	12		1.0
Lead	21		0.6	18		0.6	19		0.6	17		0.6	22800		0.60	17300		0.60	151		0.60	27400		0.60	27000		0.6	31200		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	0.24	J	0.10	0.20	J	0.10		U	0.10	0.82	J	0.10	0.94	J	0.1	0.88	J	0.10
Selenium	1.2		0.50	0.93		0.50	0.89		0.50	0.55	J	0.50	5.3		0.50	5.5		0.50		U	0.50	12		0.50	13		0.5	14		0.50
Silver		UJ	0.20		UJ	0.20		U	0.20		UJ	0.20	0.31		0.20	0.32		0.20		U	0.20	0.37		0.20	0.39		0.2	0.45		0.20

Sample Location	RSB-55C			RSB-56A			RSB-56B			RSB-56C			RSB-57A			RSB-57B			RSB-57C			RSB-58A			RSB-58B			RSB-58C		
Lab ID	230368			230342			230343			230344			230362			230363			230364			229229			229230			229231		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/11/99			8/11/99			8/11/99		
Comments																														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	60		1.0	8.6		1.0	7.7		1.0	6.1		1.0	235		1.0	127		1.0	16		1.0	247		1.0	200		1.0	37		1.0
Barium	79		1.0	129		1.0	106		1.0	147		1.0	69		1.0	74		1.0	58		1.0	92		1.0	96		1.0	65		1.0
Cadmium	30		0.50	0.53		0.50	14		0.50	0.87		0.50	25		0.50	23		0.50	3.3		0.50	40		0.50	39		0.5	16		0.50
Chromium	11		1.0	19	U	1.0	39	J	1.0	18	U	1.0	12		1.0	10		1.0	8.8		1.0	10		1.0	16		1.0	8.0		1.0
Lead	13100		0.60	30		0.60	27		0.60	88		0.60	17000		0.60	17400		0.60	3850		0.60	32000		0.60	21000		0.6	11100		0.60
Mercury	0.34	J	0.10		U	0.10		U	0.10		U	0.10	0.65	J	0.10	0.33	J	0.10		U	0.10	0.94		0.10	0.45		0.1	0.19		0.10
Selenium	5.4		0.50	1.4		0.50	0.98		0.50	0.83		0.50	9.7		0.50	4.2		0.50	1.4	J	0.50	8.3	J	0.50	7.8		0.5	2.7	U	0.50
Silver	0.22		0.20		UJ	0.20		UJ	0.20		UJ	0.20	0.27		0.20	0.41		0.20		U	0.20	0.38		0.20	0.32		0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist *Dan Mh* Date *12/21/99*

BEECH GROVE
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-63A			RSB-63B			RSB-63D			RSB-64A			RSB-64B			RSB-65A			RSB-65B			RSB-66A			RSB-66B			RSB-67A		
Lab ID	232817			232818			232819			232811			232812			230186			230187			230184			230185			230188		
Matrix	soil			soil			soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	9/20/99			9/20/99			9/20/99			9/20/99			9/20/99			8/21/99			8/21/99			8/21/99			8/21/99			8/21/99		
Comments							FD of RSB-63B																							
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	16	J	1.0	3.4	J	1.0	5.4	J	1.0	32	J	1.0	9.8	J	1.0	7.3		1.0	6.6		1.0	8.5		1.0	8.1		1.0	9.1		1.0
Barium	67	J	1.0	35	J	1.0	39	J	1.0	63	J	1.0	68	J	1.0	60		1.0	48		1.0	73		1.0	78		1.0	67		1.0
Cadmium	8.3		0.50	1.1		0.50	1.3		0.50	7.5		0.50	6.8		0.50	0.54		0.50		U	0.50	0.75		0.50	0.72		0.5	0.94		0.50
Chromium	13		1.0	6.5		1.0	9.1		1.0	13		1.0	11		1.0	10		1.0	9.2		1.0	16		1.0	12		1.0	13		1.0
Lead	1330		0.60	131		0.60	154		0.60	1470		0.60	214		0.60	126	J	0.60	13	J	0.60	222	J	0.60	106	J	0.6	225	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	1.2	J	0.50		UJ	0.50	0.63	J	0.50	0.99	J	0.50	0.74	J	0.50	1.3	J	0.50	0.83		0.50	0.98		0.50	0.73		0.5	1.2		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-67B			RSB-68A			RSB-68B			RSB-69A			RSB-69B			RSB-69C			RSB-70A			RSB-70B			RSB-70C			RSB-71A		
Lab ID	230189			230190			230191			232813			232814			232815			232808			232809			232810			230208		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/21/99			8/21/99			8/21/99			9/20/99			9/20/99			9/20/99			9/20/99			9/20/99			9/20/99			8/21/99		
Comments																														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	6.4		1.0	7.3		1.0	6.7		1.0	55	J	1.0	13	J	1.0	5.6	J	1.0	212	J	1.0	323	J	1.0	5.5	J	1.0	215		1.0
Barium	57		1.0	63		1.0	59		1.0	51	J	1.0	62	J	1.0	204	J	1.0	23	J	1.0	48	J	1.0	37	J	1.0	264		1.0
Cadmium	0.77		0.50	0.75		0.50	0.63		0.50	13		0.50	8.6		0.50	0.87		0.50	24		0.50	40		0.50	0.36		0.5	15		0.50
Chromium	8.5		1.0	11		1.0	11		1.0	11		1.0	7.9		1.0	13		1.0	6.0		1.0	11		1.0	9.0		1.0	16		1.0
Lead	141	J	0.60	201	J	0.60	128	J	0.60	2750		0.60	678		0.60	54		0.60	6420		0.60	13100		0.60	11		0.6	66800		0.60
Mercury		U	0.10		U	0.10		U	0.10	0.14		0.10	0.12		0.10		U	0.10	0.42		0.10	0.66		0.10		U	0.1	0.12		0.10
Selenium	0.72		0.50	0.79		0.50	1.2	J	0.50	1.6	J	0.50	0.84	J	0.50	0.68	J	0.50	0.98	J	0.50	1.9	J	0.50	0.68	J	0.5	8.3		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2	1.4		0.20

DL - Detection Limit prior to any dilutions.

Q - Qualifier.

U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.

J - Denotes an estimated result.

FD - Field duplicate.

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QA Scientist Diane M[...] Date 12/21/99

BEECH GROV[illegible]
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999
Laboratory	TriMatrix Laboratories
Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-72A			RSB-72B			RSB-72C			RSB-73A			RSB-73B			RSB-73C			RSB-73D			RSB-74A			RSB-74B			RSB-74C		
Lab ID	230209			230210			230211			230204			230205			230206			230207			229934			229235			229236		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/21/99			8/21/99			8/21/99			8/21/99			8/21/99			8/21/99			8/21/99			8/20/99			8/20/99			8/20/99		
Comments																			FD of RSB-73C											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	8.7		1.0	7.0		1.0	8.2		1.0	18		1.0	11		1.0	7.6		1.0	8.1		1.0	13	J	1.0	9.0	J	1.0	4.9	J	1.0
Barium	57		1.0	44		1.0	37		1.0	109		1.0	181	J	1.0	86		1.0	85		1.0	134	J	1.0	133	J	1.0	124	J	1.0
Cadmium		U	0.50		U	0.50		U	0.50	33		0.50	1.1		0.50	0.85		0.50	1.2		0.50	0.70		0.50		U	0.5	0.55		0.50
Chromium	10		1.0	8.0		1.0	9.0		1.0	29		1.0	26		1.0	11		1.0	14		1.0	16	J	1.0	19	J	1.0	14	J	1.0
Lead	34	U	0.60	15	U	0.60	15	U	0.60	6710		0.60	145	J	0.60	178		0.60	179		0.60	380	J	0.60	177	J	0.6	75	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium		U	0.50	0.51		0.50	1.3	J	0.50	2.5		0.50	1.5	J	0.50	1.5		0.50	1.5		0.50	1.1	J	0.50	0.77	J	0.5	0.55	J	0.50
Silver		U	0.20		U	0.20		U	0.20	2.6		0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-75A			RSB-75B			RSB-75D			RSB-75C			RSB-76A			RSB-76B			RSB-76C			RSB-76D			RSB-77A			RSB-77B		
Lab ID	229938			229939			229940			229941			229930			229931			229932			229933			230179			230180		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99		
Comments							FD of RSB-75B															FD of RSB-76C								
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	58	J	1.0	15	J	1.0	18	J	1.0	12	J	1.0	24	J	1.0	10	J	1.0	7.7	J	1.0	6.0	J	1.0	7.0		1.0	7.7		1.0
Barium	203	J	1.0	61	J	1.0	65	J	1.0	54	J	1.0	115	J	1.0	193	J	1.0	114	J	1.0	89	J	1.0	46		1.0	45		1.0
Cadmium	7.3		0.50	2.0		0.50	1.7		0.50	1.9		0.50	6.2		0.50	1.8		0.50		U	0.50		U	0.50	0.80		0.5	1.6		0.50
Chromium	19		1.0	8.7		1.0	12		1.0	11		1.0	22	J	1.0	16	J	1.0	18	J	1.0	9.9	J	1.0	9.8		1.0	10		1.0
Lead	3220	J	0.60	1500	J	0.60	1450	J	0.60	962	J	0.60	4.7	U	0.6	648	J	0.60	72	J	0.60	78	J	0.60	10700	J	0.6	2920	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	5.2	J	0.50	1.2	J	0.50	1.6	J	0.50	0.99	J	0.50	2.0	J	0.50	0.93	J	0.50	0.73	J	0.50	1.4	J	0.50	1.5		0.5	0.75		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Denise Mane Date 12/21/99

BEECH GRO FI
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-77D			RSB-77C			RSB-78A			RSB-78B			RSB-78C			RSB-79A			RSB-79B			RSB-79C			RSB-80A			RSB-80B		
Lab ID	230182			230181			230241			230242			230243			230276			230277			230278			230271			230272		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/99			8/20/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99		
Comments	FD of RSB-77B																													
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	8.3		1.0	6.6		1.0	14		1.0	12		1.0	13		1.0	8.5	J	1.0	6.9	J	1.0	8.1	J	1.0	7.4	J	1.0	7.0	J	1.0
Barium	44		1.0	44		1.0	132		1.0	64		1.0	62		1.0	167	J	1.0	62	J	1.0	89	J	1.0	215	J	1.0	62	J	1.0
Cadmium	2.6		0.50	0.53		0.50	12		0.50	8.6		0.50	9.3		0.50	1.6		0.50	6.4		0.50	3.8		0.50		U	0.5		U	0.50
Chromium	10		1.0	9.5		1.0	14	J	1.0	8.7	J	1.0	10	J	1.0	22	J	1.0	11	J	1.0	14	J	1.0	14	J	1.0	10	J	1.0
Lead	1090	J	0.60	232	J	0.60	3060		0.60	2600		0.60	2960		0.60	57	J	0.60	205	J	0.60	164	J	0.60	85	J	0.6	23	U	0.6
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	1.6		0.50	1.3	J	0.50	1.8	J	0.50	1.1	J	0.50	2.1	J	0.50	1.1		0.50	0.54		0.50	0.91		0.50	1.1		0.5	0.52		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-80D			RSB-80C			RSB-81A			RSB-81B			RSB-81C			RSB-82A			RSB-82B			RSB-82C			RSB-83A			RSB-83B		
Lab ID	230274			230273			230244			230245			230270			230287			230288			230289			230279			230280		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99		
Comments	FD of RSB-80B																													
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	17	J	1.0	6.7	J	1.0	9.4		1.0	9.3		1.0	7.0		1.0	8.5		1.0	24		1.0	9.3		1.0	9.9	J	1.0	7.4	J	1.0
Barium	164	J	1.0	55	J	1.0	112		1.0	157		1.0	91		1.0	93		1.0	300		1.0	92		1.0	115	J	1.0	47	J	1.0
Cadmium	0.93		0.50		U	0.50	0.62		0.50	0.54		0.50		U	0.50		U	0.50	0.90		0.50		U	0.50		U	0.5		U	0.50
Chromium	27	J	1.0	9.4	J	1.0	18	J	1.0	19	J	1.0	11	J	1.0	27		1.0	53		1.0	16		1.0	19	J	1.0	10	J	1.0
Lead	80	J	0.60	23	U	0.6	229	J	0.60	18	U	0.6	11	U	0.6	16	J	0.60	37	J	0.60	16	J	0.60	17	U	0.6	11	U	0.6
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	1.4		0.50	0.55		0.50	1.6	J	0.50	0.64	J	0.50	0.62	J	0.50	0.65		0.50	2.2		0.50	0.67		0.50	1.0		0.5		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Denise M[illegible] Date 12/21/99

BEECH GRO[illegible]I
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSB-83C			RSB-84A			RSB-84B			RSB-84C			RSB-85A		
Lab ID	230281			230290			230291			230330			230283		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/23/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	16	J	1.0	10		1.0	15		1.0	5.7	J	1.0	7.1		1.0
Barium	81	J	1.0	181		1.0	110	J	1.0	48		1.0	55		1.0
Cadmium	2.0		0.50		U	0.50	0.96		0.50		U	0.50		U	0.50
Chromium	23	J	1.0	23		1.0	26		1.0	9.0	U	1.0	8.7		1.0
Lead	31	J	0.60	16	J	0.60	21	J	0.60	12		0.60	9.1	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	1.2		0.50	0.91		0.50	1.3		0.50	0.60	J	0.50		U	0.50
Silver		U	0.20		U	0.20		UJ	0.20		U	0.20		U	0.20

Sample Location	RSB-85B			RSB-85D			RSB-85C			RSB-AA			RSB-AB		
Lab ID	230284			230286			230285			229446			229447		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/16/99			8/16/99		
Comments				FD of RSB-85B											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	6.7		1.0	6.6		1.0	7.0		1.0	10		1.0	7.1		1.0
Barium	44		1.0	46		1.0	40		1.0	77		1.0	75		1.0
Cadmium		U	0.50		U	0.50		U	0.50	2.5		0.5	1.2		0.50
Chromium	9.9		1.0	9.5		1.0	10		1.0	13		1.0	11		1.0
Lead	8.2	J	0.60	8.6	J	0.60	8.7	J	0.60	966		0.6	269		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.1		U	0.10
Selenium	0.59		0.50	0.56		0.50	0.62		0.50	0.96	U	0.5	0.66	U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.2		U	0.20

Sample Location	RSB-BA			RSB-BB			RSED-1A			RSED-1B			RSED-2A		
Lab ID	229448			229449			230376			230377			230378		
Matrix	Soil			Soil			Sediment			Sediment			Sediment		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/16/99			8/16/99			8/22/99			8/22/99			8/22/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	19		1.0	8.4		1.0	310		1.0	263		1.0	713		1.0
Barium	54		1.0	66		1.0	118		1.0	140		1.0	147		1.0
Cadmium	5.5		0.50	1.3		0.50	55		0.50	41		0.50	93		0.50
Chromium	12		1.0	11		1.0	19		1.0	14		1.0	17		1.0
Lead	2430		0.60	490		0.60	19300		0.60	29900		0.60	73800		0.60
Mercury	0.12		0.10		U	0.10	3.2		0.10	4.8		0.10	6.8		0.10
Selenium	1.1	U	0.50	0.69	U	0.50	7.3		0.50	10		0.50	10		0.50
Silver		U	0.20		U	0.20	0.65		0.20	0.86		0.20	1.0		0.20

Sample Location	RSED-2B			RSED-2C			RSED-3A			RSED-3B			RSED-4A		
Lab ID	230379			230380			230381			230382			230383		
Matrix	Sediment			Sediment			Sediment			Sediment			Sediment		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/22/99			8/22/99			8/22/99			8/22/99			8/22/99		
Comments				FD of RSED-2B											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	229		1.0	266		1.0	740		1.0	184		1.0	2300		1.0
Barium	90		1.0	85		1.0	205		1.0	101		1.0	372		1.0
Cadmium	81		0.50	80		0.50	54		0.50	37		0.5	109		0.50
Chromium	27		1.0	27		1.0	15		1.0	20		1.0	8.3		1.0
Lead	4080		0.60	5190		0.60	95300		0.60	8420		0.6	24300		0.60
Mercury	0.74		0.10	0.81		0.10	12		0.10	1.0	J	0.1	10		0.10
Selenium	1.9		0.50	2.3		0.50	15		0.50	2.5		0.5	46	J	0.50
Silver		U	0.20		U	0.20	1.6		0.20	0.24		0.2	3.6		0.20

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QA Scientist Diane M[illegible] Date 12/21/99

BEECH GROVE
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999	Method	SW-846 6010B, 7470 & 7471

Sample Location	RSED-4B			RSED-5A			RSED-5B			RSED-6A			RSED-6B			RSED-6C			RSED-7A			RSED-7B			RSED-8A			RSED-8B		
Lab ID	230384			230385			230386			230598			230599			230600			230596			230597			230560			230561		
Matrix	Sediment			Sediment			Sediment			Sediment			Sediment			Sediment			Sediment			Sediment			Sediment			Sediment		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/22/99			8/22/99			8/22/99			8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/25/99		
Comments																FD of RSED-6B														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	531		1.0	1230		1.0	3880		1.0	305		1.0	114		1.0	91		1.0	170		1.0	78		1.0	159		1.0	103		1.0
Barium	104		1.0	271		1.0	239		1.0	91		1.0	75		1.0	65		1.0	95		1.0	111		1.0	87		1.0	97		1.0
Cadmium	55		0.50	149		0.50	661		0.50	167	J	0.50	89		0.50	92		0.50	65	J	0.50	34	J	0.50	65		0.5	45		0.50
Chromium	29		1.0	12		1.0	8.6		1.0	27		1.0	22		1.0	19		1.0	18		1.0	19		1.0	21		1.0	25		1.0
Lead	17300		0.60	228000		0.60	182000		0.60	57200	J	0.60	14800		0.60	18600		0.60	46000	J	0.60	20500	J	0.60	34800		0.6	25900		0.60
Mercury	4.2		0.10	5.7		0.10	5.6		0.10	1.2		0.10	0.48		0.10	0.41		0.10	0.60		0.10	0.39		0.10	0.48		0.1	0.37		0.10
Selenium	3.3		0.50	19		0.50	12		0.50	26		0.50	6.0		0.50	4.1		0.50	10		0.50	4.3		0.50	5.9		0.5	3.8		0.50
Silver	0.33		0.20	1.7	J	0.20	1.4		0.20	0.84		0.20	0.24		0.20		U	0.20	0.62		0.20	0.26		0.20	0.45		0.2	0.35		0.20

Sample Location	RSED-9A			RSED-9B			RSED-9C			RSED-10A			RSED-10B			RSED-11A			RSED-12A			EQ-1			EQ-2			EQ-3		
Lab ID	230557			230558			230559			230554			230555			230552			230553			228732			228740			229228		
Matrix	Sediment			Sediment			Sediment			Sediment			Sediment			Sediment			Sediment			Aqueous			Aqueous			Aqueous		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			ug/L			ug/L			ug/L		
Sample Date	8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/10/99			8/10/99			8/11/99		
Comments							FD of RSED-9B															Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	124		1.0	50		1.0	57		1.0	96		1.0	61		1.0	571		1.0	1150		1.0		U	1.0		U	1.0		U	1.0
Barium	82		1.0	115		1.0	119		1.0	73		1.0	94		1.0	81		1.0	134		1.0		U	10		U	10		U	10
Cadmium	64		0.50	23		0.50	25		0.50	50		0.50	34		0.50	309	J	0.50	486	J	0.50		U	0.2		U	0.2		U	0.2
Chromium	27		1.0	19		1.0	24		1.0	18		1.0	18		1.0	41		1.0	25		1.0		U	1.0		U	1.0		U	1.0
Lead	32400		0.60	14800		0.60	17100		0.60	29300		0.60	15300		0.60	218000	J	0.60	172000	J	0.60	6.5		1.0		U	1.0	3.8		1.0
Mercury	0.41		0.10	0.17		0.10	0.15		0.10	0.28		0.10	0.17		0.10	6.4		0.10	3.3		0.10		U	0.2		U	0.2		U	0.2
Selenium	6.1		0.50	2.4		0.50	3.2		0.50	4.8		0.50	2.5		0.50	126		0.50	52		0.50		U	2.0		U	2.0		U	2.0
Silver	0.40		0.20			0.20	0.27		0.20	0.32		0.20		U	0.20	2.2		0.20	2.1		0.20		U	0.2		U	0.2		U	0.2

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QA Scientist Dan McCune Date 12/21/99

BEECH GROVE
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove		Laboratory	TriMatrix Laboratories
Project Number	98-478-03		Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999		Method	SW-846 6010B, 7470 & 7471

Sample Location	EQ-4			EQ-5			EQ-6			EQ-7			EQ-23			EQ-29			EQ-36			EQ-37			EQ-38			EQ-39		
Lab ID	229242			229237			229438			229452			229929			229937			230183			230192			230203			230214		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/12/99			8/13/99			8/16/99			8/16/99			8/19/99			8/20/99			8/21/99			8/21/99			8/21/99			8/22/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic	NA				U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium	NA				U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium	NA				U	1.0		U	1.0	1.1		1.0		U	1.0		U	1.0	1.1		1.0		U	1.0	1.2		1.0		U	1.0
Lead	28		1	3.4		1.0	3.4		1.0	3.9		1.0	13		1.0	47		1.0	6.5		1.0	2.2		1.0	4.0		1.0	9.0		1.0
Mercury	NA				U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium	NA				U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver	NA				U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

Sample Location	EQ-40			EQ-41			EQ-42			EQ-46			EQ-47			EQ-56			EQ-57			EQ-58			EQ-59		
Lab ID	230226			230240			230377			230275			230282			230333			230341			230354			230365		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/22/99			8/22/99			8/22/99			8/23/99			8/23/99			8/24/99			8/24/99			8/24/99			8/24/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead	2.9		1.0	2.9		1.0	57		1.0	50		1.0	28		1.0	5.0		1.0	5.0		1.0	7.9		1.0	17		1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

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U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Dann McChu Date 12/21/99

BEECH GROVE RFI
INORGANIC DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1, 9/20/1999

Laboratory	TriMatrix Laboratories
Case No.	35132-1, 2, 3, 7, 10-12, 14, 17-19, 22, 23, 25
Method	SW-846 6010B, 7470 & 7471

Sample Location	EQ-66			EQ-67			EQ-70		
Lab ID	230566			230601			232816		
Matrix	Aqueous			Aqueous			Soil		
Units	ug/L			ug/L			mg/kg		
Sample Date	8/25/99			8/25/99			9/20/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL
Arsenic		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10
Cadmium	0.2		0.2		U	0.2		U	0.2
Chromium	1.5		1.0		U	1.0		U	1.0
Lead	184		1.0	54		1.0	2.3		1.0
Mercury		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2

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QA Scientist Dean Mann Date 12/21/99

VOLATILE DATA VALIDATION SUMMARY

Site Name: RMC - Beech Grove
Project Number: 98-478-03
Sampling Date(s): 9/1/99

Laboratory: TriMatrix
Case/Order No.: 35132-4

Compound List: ☐ TCL ☐ Priority Pollutant ☐ Appendix IX ☑ Other BTE, Cumene, Napthalene

Method: ☐ CLP SOW 3/90 ☐ 40 CFR 136 ☑ SW-846 Method 8260B ☐ Other ______

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	Accept	FYI	Qualify	Comments
Holding Times	✓			received @ 3°C
GC/MS Tuning	✓			criteria reported for USEPA National guidelines, but also meets 8260B tuning criteria
Initial Calibrations	✓			
Continuing Calibrations			✓	Napthalene %D >20 for EQB-1
Blank Analysis Results		✓		did not report Napthalene and * isopropylbenzene for method blanks
System Monitoring/Surrogate Results			✓	23/3U3 - surr 1 is < control limit and greater 10% - UJ results
MS/MSD Results	✓			
Field Duplicate Results		✓		NA
Internal Standard Areas/RT	✓			
Target Compound Identification	✓			
TIC Identification		✓		NA
Quantitation/Detection Limits	✓			
System Performance	✓			
Overall Assessment of Data	✓			
Other: LCS	✓			

rec'd new forms 11/9/99 MRC

General Comments: * Napthalene present in method blank BLK0913A @ 11ug/L no hits in sample so no qualifier applies.

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased.
NR - Not Reviewed
NA - Not Applicable

QA Scientist M. Ritchie
Date 10/20/99

Evaluate Continuing Calibration Report FORM 7

Data File : C:\HPCHEM\1\DATA\40P0913B.D Vial: 0
Acq On : 13 SEP 1999 17:38 Operator:
Sample : Inst :
Misc : Multiplr: 1.00
MS Integration Params: rteint.p

Associated Samples:
EQB-1
Napthalene %D 720

Method : C:\SAT132\QUANT\8260B-11.M (RTE Integrator)
Title : Saturn 132
Last Update : Mon Aug 23 08:53:45 1999
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 30% Max. Rel. Area : 200%

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
1	I	IS: Flourobenzene	1.000	1.000	0.0	82	0.00
2	T	Dichlorodifluoromethane	0.266	0.151	43.2#	42#	-0.03
3	TP	Chloromethane	0.237	0.206	13.1	70	0.03
4	TC	Vinyl Chloride	0.172	0.157	8.7	69	0.00
5	T	Bromomethane	0.239	0.217	9.2	78	0.00
6	T	Chloroethane	0.037	0.035	5.4	72	-0.02
7	T	Trichlorofluoromethane	0.473	0.491	-3.8	74	-0.01
8	T	Ethyl Ether	0.164	0.176	-7.3	83	0.00
9	T	Acrolein	0.017	0.000	100.0#	1#	0.05
10	TCM	1,1-Dichloroethene	0.211	0.209	0.9	78	0.00
11	T	Trichlorotrifluoroethane	0.320	0.299	6.6	70	0.03
[illegible]	T	Iodomethane	0.658	0.562	14.6	69	0.00
13	T	Carbon Disulfide	0.398	0.354	11.1	69	-0.01
14	T	Acetone	0.146	0.181	-24.0	97	0.00
15	T	Isopropanol	0.012	0.009	25.0	65	-0.01
16	T	Methylene Chloride	0.675	0.637	5.6	75	0.00
17	T	Acrylonitrile	0.183	0.000	100.0#	0#	-0.05
18	T	trans-1,2-Dichloroethene	0.253	0.238	5.9	76	0.00
19	T	Methyl(tert)Butyl Ether	0.558	0.545	2.3	79	-0.01
20	TP	1,1-Dichloroethane	0.282	0.258	8.5	73	0.00
21	T	Vinyl Acetate	0.694	0.716	-3.2	81	0.00
22	T	2,2-Dichloropropane	0.308	0.234	24.0	62	0.00
23	T	cis-1,2-Dichloroethene	0.296	0.287	3.0	78	0.00
24	T	Methyl Ethyl Ketone	0.161	0.216	-34.2#	112	0.00
25	T	Bromochloromethane	0.510	0.494	3.1	76	0.00
26	TC	Chloroform	0.492	0.455	7.5	77	0.01
27	T	1,1,1-Trichloroethane	0.561	0.553	1.4	76	0.00
28	S	SUR: Dibromofluoromethane	0.357	0.315	11.8	77	-0.01
29	T	Carbon Tetrachloride	0.507	0.417	17.8	64	0.00
30	T	1,1-Dichloropropene	0.289	0.281	2.8	77	0.00
31	TM	Benzene	0.881	0.851	3.4	78	0.00
32	T	1,2-Dichloroethane	0.427	0.396	7.3	75	0.00
33	T	Heptane	0.346	0.366	-5.8	82	0.00
34	S	SUR: 1,2-Dichloroethane-d4	0.356	0.313	12.1	72	-0.01
35	TM	Trichloroethene	0.301	0.281	6.6	75	0.00
36	TC	1,2-Dichloropropane	0.167	0.158	5.4	75	0.00
[illegible]	T	Dibromomethane	0.288	0.258	10.4	71	0.00
[illegible]	T	Bromodichloromethane	0.415	0.362	12.8	70	0.00
39	T	2-Chloroethyl Vinyl Ether	0.114	0.115	-0.9	82	0.00
40	T	cis-1,3-Dichloropropene	0.389	0.341	12.3	70	0.00
41	T	4-Methyl-2-Pentanone	0.261	0.296	-13.4	96	0.00

(#) = Out of Range

Evaluate Continuing Calibration Report

Data File : C:\HPCHEM\1\DATA\40P0913B.D Vial: 0
Acq On : 13 SEP 1999 17:38 Operator:
Sample : Inst :
Misc : Multiplr: 1.00
MS Integration Params: rteint.p

Method : C:\SAT132\QUANT\8260B-11.M (RTE Integrator)
Title : Saturn 132
Last Update : Mon Aug 23 08:53:45 1999
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 30% Max. Rel. Area : 200%

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
42	S	SUR: d8-Toluene	1.249	1.120	10.3	78	0.00
43	I	~~IS: d5~~-Chlorobenzene	1.000	1.000	0.0	74	0.00
44	TCM	Toluene	3.604	3.857√	-7.0	77	0.02
45	T	trans-1,3-Dichloropropene	0.852	0.867	-1.8	73	0.00
46	T	1,1,2-Trichloroethane	0.453	0.433	4.4	68	0.00
47	T	Tetrachloroethene	0.540	0.535	0.9	70	0.00
48	T	1,3-Dichloropropane	0.591	0.592	-0.2	78	0.00
49	T	2-Hexanone	0.449	0.538	-19.8	81	0.00
50	T	Dibromochloromethane	1.058	0.993	6.1	68	0.00
51	T	1,2-Dibromoethane	0.929	0.914	1.6	72	-0.01
[illegible]	TPM	Chlorobenzene	1.999	2.169	-8.5	75	0.00
[illegible]	T	1,1,1,2-Tetrachloroethane	0.782	0.785	-0.4	70	0.00
54	TC	Ethyl Benzene	3.692	3.821	-3.5	77	0.00
55	T	m/p-Xylene	3.308	3.493	-5.6	75	0.00
56	T	o-Xylene	3.494	3.435	1.7	71	0.00
57	T	Styrene	2.075	2.130	-2.7	74	0.00
58	TP	Bromoform	0.685	0.578	15.6	64	-0.01
59	T	Isopropylbenzene	3.145	3.044	3.2	69	0.00
60	S	Sur: 4-Bromofluorobenzene	1.236	1.234	0.2	75	0.00
61	I	IS: d4-1,4-Dichlorobenzene	1.000	1.000	0.0	63	0.00
62	T	1,4-trans-2-dichlorobutene	0.422	0.393√	6.9	64	0.00
63	T	Bromobenzene	1.210	1.332	-10.1	77	0.00
64	TP	1,1,2,2-Tetrachloroethane	0.756	0.684	9.5	60	0.00
65	T	1,2,3-Trichloropropane	1.036	1.027	0.9	67	-0.02
66	T	n-Propylbenzene	3.803	4.127	-8.5	73	0.00
67	T	2-Chlorotoluene	0.672	0.740	-10.1	75	0.01
68	T	1,3,5-Trimethylbenzene	2.973	3.141	-5.7	71	0.00
69	T	4-Chlorotoluene	3.299	3.490	-5.8	71	0.00
70	T	tert-Butylbenzene	2.062	2.407	-16.7	75	0.01
71	T	1,2,4-Trimethylbenzene	2.951	3.606	-22.2	81	0.00
72	T	sec-Butylbenzene	2.860	3.302	-15.5	79	0.00
73	T	1,3-Dichlorbenzene	1.530	1.549	-1.2	68	0.00
74	T	4-Isopropyltoluene	2.409	2.787	-15.7	83	0.00
75	T	1,4-Dichlorobenzene	1.662	1.622	2.4	66	0.00
76	T	1,2-Dichlorobenzene	1.384	1.353	2.2	61	0.00
[illegible]	T	n-Butylbenzene	2.605	2.662	-2.2	66	0.00
[illegible]	T	1,2-Dibromo-3-chloropropane	0.240	0.128	46.7#	36#	0.00
79	T	1,2,4-Trichlorobenzene	0.961	0.401	58.3#	28#	0.00
80	T	Hexachlorobutadiene	0.485	0.305	~~37.1#~~	42#	0.00
81	T	Naphthalene	2.679	0.842	68.6#	21#	0.00

(#) = Out of Range

INR 14a

Evaluate Continuing Calibration Report

Data File : C:\HPCHEM\1\DATA\40P0913B.D
Vial: 0
Acq On : 13 SEP 1999 17:38
Operator:
Sample :
Inst :
Misc :
Multiplr: 1.00
MS Integration Params: rteint.p

Method : C:\SAT132\QUANT\8260B-11.M (RTE Integrator)
Title : Saturn 132
Last Update : Mon Aug 23 08:53:45 1999
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 30% Max. Rel. Area : 200%

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
82	T	1,2,3-Trichlorobenzene	0.902	0.238	73.6#	17#	0.00

MNR 10/20/99

(#) = Out of Range SPCC's out = 0 CCC's out = 0

TriMatrix Laboratories, Inc.

35132- 24

QUALITY CONTROL REPORT
SURROGATE RECOVERIES
USEPA CLP FORM 2

Method: Volatiles Purge & Trap-GC/MS USEPA-8260B SOIL

Surrogate Compound List

SUR-1: Dibromofluoromethane
SUR-2: d8-Toluene
SUR-3: 4-Bromofluorobenzene

% R = Percent Recovery

		SUR-1	SUR-2	SUR-3
	Compounds:	SUR-1	SUR-2	SUR-3
	Control Limits:	74-131	78-122	79-125
Sample # / ID	Batch	% R	% R	% R
MPB-114	47646	104	100	109
LFB-114	47646	101	98	105
231362SPK	47646	99	97	106
231362SPK	47646	101	97	105
231361	47646	99	100	108
231362	47646	100	98	109
231363	47646	65	99	109
231364	47646	98	99	109
231365	47646	88	99	109
231366	47646	99	100	109
231367	47646	100	99	109

Associated sample:

RD-11A

detection limit "UJ"

HMR
10/20/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
METHOD PREPARATION BLANK

Method: Volatiles Purge & Trap-GC/MS
Analyst: Jeff Glaser
Test Date: 09/13/99
Analytical Batch No: 146886
QC Batch No: 46950-213
Units: ug/L

Parameter	Blank Concentration	Quantitation Limit
Benzene	<1.0	1.0
Ethylbenzene	<1.0	1.0
Toluene	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Naphthalene	11	5.0

Associated samples:

EQB-1

no qualifiers applied
no hits in sample.

MHR
11/9/99

Quantitation Report

Data File : c:\hpchem\1\data\BLK0913A.D Vial: 0
Acq On : 13 SEP 1999 18:22 Operator:
Sample : Inst :
Misc : Multiplr: 1.00
MS Integration Params: rteint.p
Quant Time: Sep 13 19:00 1999 Quant Results File: 8260b-11.RES

Quant Method : c:\sat132\quant\8260b-11.m (RTE Integrator)
Title : Saturn 132
Last Update : Mon Aug 23 08:53:45 1999
Response via : Initial Calibration
DataAcq Meth :
IS QA File : C:\HPCHEM\1\DATA\40P08131.D (13 AUG 1999 11:40)

Internal Standards	R.T.	QIon	Response	Conc Units	Dev(Min) Rcv(Ar)
1) IS: Flourobenzene	16.29	96	1209876	40.00 ug/L	0.00
					74.73%
43) IS: d5-Chlorobenzene	23.19	82	535413	40.00 ug/L	-0.02
					79.25%
61) IS: d4-1,4-Dichlorobenzene	29.01	152	482426	40.00 ug/L	0.00
					64.93%

System Monitoring Compounds	R.T.	QIon	Response	Conc Units	Dev(Min)
28) SUR: Dibromofluoromethane	14.86	113	399310	37.03 ug/L	0.00
Spiked Amount 40.000			Recovery	= 92.58%	
34) SUR: 1,2-Dichloroethane-d4	15.56	65	416918	38.70 ug/L	0.00
Spiked Amount 40.000			Recovery	= 96.75%	
42) SUR: d8-Toluene	19.82	98	1430184	37.87 ug/L	0.02
Spiked Amount 40.000			Recovery	= 94.68%	
60) Sur: 4-Bromofluorobenzene	26.14	95	603901	36.50 ug/L	0.00
Spiked Amount 40.000			Recovery	= 91.25%	

Target Compounds	R.T.	QIon	Response	Conc Units	Qvalue
14) Acetone	9.59	43	5575	1.26 ug/L #	90
15) Isopropanol	10.41	45	2442	6.89 ug/L #	95
24) Methyl Ethyl Ketone	13.91	43	17445	3.59 ug/L #	93
33) Heptane	16.31	41	38840	3.71 ug/L #	1
41) 4-Methyl-2-Pentanone	19.83	43	12452	1.43 ug/L #	78
66) n-Propylbenzene	26.81	91	28145	0.61 ug/L #	97
68) 1,3,5-Trimethylbenzene	27.25	105	22307	0.62 ug/L #	82
70) tert-Butylbenzene	28.09	119	22723	0.91 ug/L	98
71) 1,2,4-Trimethylbenzene	28.20	105	22289	0.63 ug/L	100
72) sec-Butylbenzene	28.61	105	51755	1.50 ug/L #	93
73) 1,3-Dichlorbenzene	28.86	146	11475	0.62 ug/L	94
74) 4-Isopropyltoluene	28.94	119	41047	1.41 ug/L #	90
75) 1,4-Dichlorobenzene	29.07	146	11808	0.59 ug/L	92
76) 1,2-Dichlorobenzene	29.88	146	12263	0.73 ug/L	91
77) n-Butylbenzene	29.85	91	64954	2.07 ug/L #	96
78) 1,2-Dibromo-3-chloropropan	31.45	75	13157	4.55 ug/L	95
79) 1,2,4-Trichlorobenzene	33.22	180	85713	7.40 ug/L	96
80) Hexachlorobutadiene	33.62	225	38459	6.57 ug/L	94
81) Naphthalene	33.79	128	348056	10.77 ug/L	99
82) 1,2,3-Trichlorobenzene	34.37	180	115087	10.58 ug/L	97

(#) = qualifier out of range (m) = manual integration

SEMIVOLATILE DATA VALIDATION SUMMARY

Site Name: RMC Beech Grove, IN
Project Number: 98-478-03
Sampling Date(s): 9/1/99

Laboratory: TriMatrix
Case/Order No.: 35132-24

Compound List: ☐ TCL ☐ Priority Pollutant ☐ Appendix IX ☑ Other Fluorene, Phenanthrene

Method: ☐ CLP SOW 3/90 ☐ 40 CFR 136 ☑ SW-846 Method 8270 ☐ Other ______

The following table indicates the data validation criteria examined, any problems identified, and the QA action app

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times	✓			received @ 3°C
GC/MS Tuning		✓		tune criteria - National guidelines does not pass 8270C criteria
Initial Calibrations	✓			
Continuing Calibrations	✓			
Blank Analysis Results	✓			
System Monitoring/Surrogate Results	✓			
MS/MSD Results	✓			
Field Duplicate Results		✓		NA
Internal Standard Areas/RT	✓			
Target Compound Identification	✓			
TIC Identification		✓		NA
Quantitation/Detection Limits	✓			
System Performance	✓			
Overall Assessment of Data	✓			
Other: LCS	✓			

General Comments: ______

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased.

NA - Not analyzed.
NR - Not reviewed.

QA Scientist M. Ritchie
Date 10/20/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -2	Parameter	Selenium, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47060	Method Preparation	1	0.73

229219, 229221-27, 20
229229-236
Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -2	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47050	Method Preparation	1	13.5
47060	Method Preparation	1	13.3

13.3 - 229219-25, 26-34
229235-36, 38
(all above 5x MB)

13.5 - 229167, 68, 69, 70, 71 - not AGC samples

DIm

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -3	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47105	Method Preparation	1	3.2

Associated samples:
229431-37
229439-457
DJM 11/17/99

all > 5x Blk

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -3	Parameter	Selenium, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47105	Method Preparation	1	1.0

Associated Samples:
229431, 229434, 229435, 32, 33, 36
229437, 229439-43, 44, 49
229445-48, 229450-51
DIM 11/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -3	Parameter	Arsenic, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47105	Method Preparation	1	1.2

Associated Samples:
229431-37
229439-451
DIM 11/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -7	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47157	Method Preparation	1	1.24

Associated data:
229922, 229923, 229924, 21
229925, 26, 27, 28, 31, 32, 33, 34, 30
35, 36, 39, 40, 41, 44, 38

Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -10	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47158	Method Preparation	1	7.44
47159	Method Preparation	1	0.70

7.44 - Associated samples -
230200, 202, 205, 206, 207, 209, 210, 204
211, 212, 213, 215, 216, 217, 218, 219
220, 221, 222,

0.70 - Associated samples:
229969, 230179, 230180, 181, 182, 184, 185, 186, 187, 188, 189,
190, 191, 193, 194, 195, 196, 197, 198, 199

DJM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -12	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47160	Method Preparation	1	<0.60
47168	Method Preparation	1	0.61

Associated samples:
230245, 230246, 47, 48, 51, 52, 50
54, 55, 56, 57, 59, 60, 61, 63, 64
65, 66, 67, 68

all over 5x MB
JLM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -13	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47168	Method Preparation	1	0.61
47623	Method Preparation	1	<0.60

Associated data:
230 245, 246, 247, 248,
~~250~~, 251, 252, 254, 255
256, 257, 259, 260, 263
264, 265

Dim

all > 5X MB

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -14	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47623	Method Preparation	1	<0.60
47812	Method Preparation	1	1.98

Associated data:
230291, 293, 295, 297, 298,
299, 300, 302, 303, 304, 305,
306, 307, 308

DIM

all > 5x MB

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -16	Parameter	Chromium, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47813	Method Preparation	1	6.83

Associated data:
230316, 319, 320, 321,
322, 323, 324, 325) 327
328 + 329, 30, 31, 32, 34-38
Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -18	Parameter	Chromium, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47811	Method Preparation	1	<1.0
47814	Method Preparation	1	4.40

Associated data: 230339, 40, 42, 43, 44,
45, 46, 47, 48, 49, 50, 51, 52
53, 56, 57, 58, 59, 60
Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -18	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47811	Method Preparation	1	1.18
47814	Method Preparation	1	<0.60

Associated data:
230361,
230372
230373, 374

all > 5x MB
Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -25	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47852	Method Preparation	1	0.61

Associated samples:

232808-815, 817-19
DJM
All > 5x MB

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -7	Matrix	SOIL
		Lab Sample No.	229935
Sample ID.	RSB74BMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Arsenic, Total	73 - 121	124.9	9.0		125	93	MS
Arsenic, Total	73 - 121	100.4	9.0		125	73	MS
Barium, Total	69 - 131	237.8	133		125	84	MS
Barium, Total	69 - 131	222.0	133		125	71	MS
Cadmium, Total	83 - 114	25.9	<0.50	U	25.0	104	MS
Cadmium, Total	83 - 114	25.4	<0.50	U	25.0	102	MS
Chromium, Total	69 - 130	142.4	19		125	99	MS
Chromium, Total	69 - 130	131.1	19		125	90	MS
Lead, Total	74 - 132	262.6	177		125	68	MS
Lead, Total	74 - 132	333.7	177		125	125	MS
Mercury, Total	73 - 136	0.478	<0.10	U	0.417	115	CV
Mercury, Total	73 - 136	0.458	<0.10	U	0.417	110	CV
Selenium, Total	62 - 126	75.0	0.77		125	59	MS
Selenium, Total	62 - 126	116.6	0.77		125	93	MS
Silver, Total	78 - 115	23.0	<0.20	U	25.0	92	MS
Silver, Total	78 - 115	22.9	<0.20	U	25.0	92	MS

Associated Samples:
229921, 22, 23, 24, 25, 26, 27, 28, 30
31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 44

DM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No.	35132 -7	Matrix	SOIL
		Lab Sample No.	229935
Sample ID.	RSB74BMS/MSD	Units	mg/kg dry

Analyte	Control Limit	Sample Result	Duplicate Spike Result	RPD	M
Arsenic, Total	0 - 20	124.9	100.4	22	MS
Barium, Total	0 - 20	237.8	222.0	7	MS
Cadmium, Total	0 - 20	25.9	25.4	2	MS
Chromium, Total	0 - 20	142.4	131.1	8	MS
Lead, Total	0 - 20	262.6	333.7	24	MS
Mercury, Total	0 - 20	0.478	0.458	4	CV
Selenium, Total	0 - 20	116.6	75.0	43	MS
Silver, Total	0 - 20	22.9	23.0	0	MS

Associated Samples:
229921-28, 229930-36
229938-41, 229944
DM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -14

Sample ID. RSB79BMS/MSD

Matrix SOIL
Lab Sample No. 230277
Units mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Arsenic, Total	73 - 121	123.5	6.9		125	93	MS
Arsenic, Total	73 - 121	128.9	6.9		125	98	MS
Barium, Total	69 - 131	170.7	62		125	87	MS
Barium, Total	69 - 131	179.9	62		125	94	MS
Cadmium, Total	83 - 114	28.5	6.4		25	88	MS
Cadmium, Total	83 - 114	29.5	6.4		25	92	MS
Chromium, Total	69 - 130	123.2	11		125	90	MS
Chromium, Total	69 - 130	130.6	11		125	96	MS
Lead, Total	74 - 132	253.9	205		125	39	MS
Lead, Total	74 - 132	299.5	205		125	76	MS
Mercury, Total	73 - 136	0.481	<0.10	U	0.417	115	CV
Mercury, Total	73 - 136	0.473	<0.10	U	0.417	113	CV
Selenium, Total	62 - 126	114.9	0.54		125	91	MS
Selenium, Total	62 - 126	110.0	0.54		125	88	MS
Silver, Total	78 - 115	21.6	<0.20	U	25	86	MS
Silver, Total	78 - 115	21.9	<0.20	U	25	88	MS

Associated samples:
230269-74, 230276-81
230283-90

Dm

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -15

Sample ID. CSBCSB29CMS/MSD

Matrix SOIL
Lab Sample No. 230304
Units mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	68 - 126	97.3	1.5		100	96	MS
Antimony, Total	68 - 126	101.4	1.5		100	100	MS
Arsenic, Total	73 - 121	109.8	11		125	79	MS
Arsenic, Total	73 - 121	108.2	11		125	78	MS
Barium, Total	69 - 131	185.4	100		125	68	MS
Barium, Total	69 - 131	183.9	100		125	67	MS
Cadmium, Total	83 - 114	21.3	0.73		25	82	MS
Cadmium, Total	83 - 114	20.6	0.73		25	79	MS
Chromium, Total	69 - 130	114.9	21		125	75	MS
Chromium, Total	69 - 130	118.8	21		125	78	MS
Lead, Total	74 - 132	125.6	36		125	72	MS
Lead, Total	74 - 132	125.0	36		125	71	MS
Mercury, Total	73 - 136	0.493	<0.10	U	0.417	118	CV
Mercury, Total	73 - 136	0.495	<0.10	U	0.417	119	CV
Selenium, Total	62 - 126	117.3	1.3		125	93	MS
Selenium, Total	62 - 126	106.8	1.3		125	84	MS
Silver, Total	78 - 115	19.0	<0.20	U	25	76	MS
Silver, Total	78 - 115	18.6	<0.20	U	25	74	MS

Used 75-125% R as criteria stated in QAPP.
Associated data:
230291, 230293-95,
230297-300, 230302-308
230310-312, 230314-15
DLM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -16	Matrix	SOIL
		Lab Sample No.	230321
Sample ID.	CSB24CMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	68 - 126	92.1	<1.0	U	100	92	MS
Antimony, Total	68 - 126	93.2	<1.0	U	100	93	MS
Arsenic, Total	73 - 121	98.1	4.4		125	75	MS
Arsenic, Total	73 - 121	123.3	4.4		125	95	MS
Barium, Total	69 - 131	216.2	116		125	80	MS
Barium, Total	69 - 131	233.6	116		125	94	MS
Cadmium, Total	83 - 114	23.4	<0.50	U	25	94	MS
Cadmium, Total	83 - 114	23.5	<0.50	U	25	94	MS
Chromium, Total	69 - 130	124.7	17		125	86	MS
Chromium, Total	69 - 130	134.7	17		125	94	MS
Lead, Total	74 - 132	123.9	12		125	90	MS
Lead, Total	74 - 132	124.0	12		125	90	MS
Mercury, Total	73 - 136	0.513	<0.10	U	0.417	123	CV
Mercury, Total	73 - 136	0.516	<0.10	U	0.417	124	CV
Selenium, Total	62 - 126	91.9	0.92		125	73	MS
Selenium, Total	62 - 126	117.0	0.92		125	93	MS
Silver, Total	78 - 115	22.5	<0.20	U	25	90	MS
Silver, Total	78 - 115	22.5	<0.20	U	25	90	MS

Associated samples:
230316, 230319, 320, 321
322, 324, 325, 327, 328
329, 330, 331, 332, 334
335, 336, 337 ~~+ 338~~
DM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No. 35132 -16

Sample ID. CSB24CMS/MSD

Matrix SOIL
Lab Sample No. 230321
Units mg/kg dry

Analyte	Control Limit	(MS) Sample Result	(MSD) Duplicate Spike Result	RPD	M
Antimony, Total	0 - 20	92.1	93.2	1	MS
Arsenic, Total	0 - 20	98.1	123.3	23	MS
Barium, Total	0 - 20	216.2	233.6	8	MS
Cadmium, Total	0 - 20	23.4	23.5	0	MS
Chromium, Total	0 - 20	124.7	134.7	8	MS
Lead, Total	0 - 20	123.9	124.0	0	MS
Mercury, Total	0 - 20	0.513	0.516	1	CV
Selenium, Total	0 - 20	91.9	117.0	24	MS
Silver, Total	0 - 20	22.5	22.5	0	MS

Associated samples:
230316, 230319, 320, 321
322, 324, 325, 327, 328,
329, 330, 331, 332, 334,
335, 336, 337 + 338
DM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -17	Matrix	SOIL
		Lab Sample No.	230338
Sample ID.	RSB26BMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result	Spike Added	%R	M
Arsenic, Total	73 - 121	290.7	184	125	85	MS
Arsenic, Total	73 - 121	485.8	184	125	241	MS
Barium, Total	69 - 131	228.5	114	125	92	MS
Barium, Total	69 - 131	219.1	114	125	84	MS
Cadmium, Total	83 - 114	33.1	10	25	92	MS
Cadmium, Total	83 - 114	37.8	10	25	111	MS
Chromium, Total	69 - 130	128.5	21	125	86	MS
Chromium, Total	69 - 130	124.5	21	125	83	MS
Mercury, Total	73 - 136	0.892	0.36	0.417	128	CV
Mercury, Total	73 - 136	0.874	0.36	0.417	123	CV
Selenium, Total	62 - 126	102.6	4.6	125	78	MS
Selenium, Total	62 - 126	116.7	4.6	125	90	MS
Silver, Total	78 - 115	22.2	0.23	25	88	MS
Silver, Total	78 - 115	22.0	0.23	25	87	MS

Hg - Estimated detected results
230334, 337, 338, 340
339
DIM

As - Estimated detected results
Associated samples:
230316, 230319-25,
230327-32, 230334-38
DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No.	35132 -17	Matrix	SOIL
		Lab Sample No.	230338
Sample ID.	RSB26BMS/MSD	Units	mg/kg dry

Analyte	Control Limit	(MS) Sample Result	(MSD) Duplicate Spike Result	RPD	M
Arsenic, Total	0 - 20	290.7	485.8	50	MS
Barium, Total	0 - 20	228.5	219.1	4	MS
Cadmium, Total	0 - 20	33.1	37.8	13	MS
Chromium, Total	0 - 20	128.5	124.5	3	MS
Mercury, Total	0 - 20	0.892	0.874	2	CV
Selenium, Total	0 - 20	102.6	116.7	13	MS
Silver, Total	0 - 20	22.0	22.2	1	MS

Associated data:
230316, 230319-25,
230327-32, 230334-38
DJM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -18 | Matrix SOIL
Lab Sample No. 230356
Sample ID. RSB52BMS/MSD | Units mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Arsenic, Total	73 - 121	124.0	5.9		125	94	MS
Arsenic, Total	73 - 121	118.1	5.9		125	90	MS
Barium, Total	69 - 131	204.4	79		125	100	MS
Barium, Total	69 - 131	197.4	79		125	95	MS
Cadmium, Total	83 - 114	23.6	0.51		25	92	MS
Cadmium, Total	83 - 114	23.3	0.51		25	91	MS
Chromium, Total	69 - 130	132.1	14		125	94	MS
Chromium, Total	69 - 130	133.9	14		125	96	MS
Lead, Total	74 - 132	208.8	77		125	105	MS
Lead, Total	74 - 132	195.8	77		125	95	MS
Mercury, Total	73 - 136	0.534	<0.10	U	0.417	128	CV
Mercury, Total	73 - 136	0.533	<0.10	U	0.417	128	CV
Selenium, Total	62 - 126	112.0	0.84		125	89	MS
Selenium, Total	62 - 126	107.8	0.84		125	86	MS
Silver, Total	78 - 115	20.7	<0.20	U	25	83	MS
Silver, Total	78 - 115	20.8	<0.20	U	25	83	MS

Hg - Associated data
Estimated detects
230352, 53, 362, 363
366, 367, 368, 369,
370, 371

Mercury 230765 MS 0.557 MSD 0.549 } Associated data Estimate detects
%R 134 132 230760 + 230587
original 0.1U spk added 0.417

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -19	Matrix	SOIL
		Lab Sample No.	230382
Sample ID.	RSED3B	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result	Spike Added	%R	M
Mercury, Total	73 - 136	1.530	1.0	0.417	127	CV
Mercury, Total	73 - 136	1.770	1.0	0.417	185	CV

Associated sample:
230382
DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -22	Matrix	SOIL
		Lab Sample No.	230596
Sample ID.	RSED7AMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result	Spike Added	%R	M
Arsenic, Total	73 - 121	296.1	170	125	101	MS
Arsenic, Total	73 - 121	302.5	170	125	106	MS
Barium, Total	69 - 131	206.5	95	125	89	MS
Barium, Total	69 - 131	225.4	95	125	104	MS
Cadmium, Total	83 - 114	103.5	65	25.0	154	MS
Cadmium, Total	83 - 114	87.5	65	25.0	90	MS
Chromium, Total	69 - 130	137.0	18	125	95	MS
Chromium, Total	69 - 130	144.1	18	125	101	MS
Lead, Total	74 - 132	70818	46000	31250	79	MS
Lead, Total	74 - 132	68224	46000	31250	71	MS
Mercury, Total	73 - 136	1.04	0.60	0.417	106	CV
Mercury, Total	73 - 136	0.913	0.60	0.417	75	CV
Selenium, Total	62 - 126	125.0	10	125	92	MS
Selenium, Total	62 - 126	124.7	10	125	92	MS
Silver, Total	78 - 115	24.5	0.62	25.0	96	MS
Silver, Total	78 - 115	24.5	0.62	25.0	96	MS

Associated Samples:
230596, 230597,
230598, 230552,
230553

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -25	Matrix	SOIL
		Lab Sample No.	232812
Sample ID.	RSB-64BMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Arsenic, Total	73 - 121	125.5	9.8		125	93	MS
Arsenic, Total	73 - 121	121.4	9.8		125	89	MS
Barium, Total	69 - 131	77.3	68		12.5	74	MS
Barium, Total	69 - 131	73.0	68		12.5	40	MS
Cadmium, Total	83 - 114	18.8	6.8		12.5	96	MS
Cadmium, Total	83 - 114	17.6	6.8		12.5	86	MS
Chromium, Total	69 - 130	20.4	11		12.5	75	MS
Chromium, Total	69 - 130	20.8	11		12.5	78	MS
Selenium, Total	62 - 126	79.7	0.74		125	63	MS
Selenium, Total	62 - 126	74.0	0.74		125	59	MS
Silver, Total	78 - 115	10.3	<0.20	U	12.5	82	MS
Silver, Total	78 - 115	11.0	<0.20	U	12.5	88	MS

Associated samples:
232808-815, 817-819
DJM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
LABORATORY FORTIFIED BLANK
USEPA CLP FORM 7

SDG No. 35132 -17 Units mg/kg dry

Analyte	Batch	True Value	Amount Found	Control Limit	%R
Arsenic, Total	47813	125	112.2	82 - 117	90
Arsenic, Total	47814	125	112.6	82 - 117	90
Barium, Total	47813	125	116.4	86 - 116	93
Barium, Total	47814	125	123.4	86 - 116	99
Cadmium, Total	47813	25	23.2	80 - 117	93
Cadmium, Total	47814	25	21.3	80 - 117	85
Chromium, Total	47813	125	107.0	83 - 122	86
Chromium, Total	47814	125	108.6	83 - 122	87
Lead, Total	47813	125	114.3	83 - 127	91
Lead, Total	47814	125	110.8	83 - 127	89
Mercury, Total	47363	0.417	0.488	84 - 124	117
Selenium, Total	47813	125	118.8	76 - 118	95
Selenium, Total	47814	125	119.9	76 - 118	96
Silver, Total	47813	25	23.3	74 - 118	93
Silver, Total	47814	25	19.8	74 - 118	79

Associated samples 230339, 40, 42, 43, 44, 45, 46
47, 48, 49, 50, 51, 52, 53, 55, 56
57, 58, 59, 60

FIELD DUPLICATE SUMMARY FORM

Site Name:	RMC Beech Grove, IN	Laboratory:	TriMatrix
Project Number:	98-478-03	Case/Order No.:	35132-1-25
Sampling Date(s):	8/10-8/26/99, 9/1/99		

Sample description or location	CFD-3	CFD-13		
Sample number	229240	229241		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Cadmium	547	474	14.30	
Lead	707000	377000	60.89	J

Sample description or location	RSB-2B	RSB-2D		
Sample number	230216	230217		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	6.6	7.4	11.43	
Barium	79	72	9.27	
Cadmium	0.99	1.1	10.53	
Chromium	16	14	13.33	
Lead	202	264	26.61	
Mercury	ND	ND	NA	
Selenium	1.10	0.74	39.13	
Silver	ND	ND	NA	

Sample description or location	RSB-7B	RSB-7D		
Sample number	229444	229445		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	6.8	6.8	0.00	
Barium	61	57	6.78	
Cadmium	0.8	0.95	17.14	
Chromium	12	11	8.70	
Lead	232	283	19.81	
Mercury	ND	ND	NA	
Selenium	1.20	1.2	0.00	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-9B	RSB-9D		
Sample number	230228	230229		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	27	28	3.64	
Barium	72	78	8.00	
Cadmium	9.7	11	12.56	
Chromium	11	12	8.70	
Lead	3800	3080	20.93	
Mercury	ND	ND	NA	
Selenium	1.90	2.2	14.63	
Silver	ND	0.25	NA	

Sample description or location	RSB-12B	RSB-12D		
Sample number	229233	229234		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	125	128	2.37	
Barium	122	110	10.34	
Cadmium	8.4	9	6.90	
Chromium	16	14	13.33	
Lead	17500	15200	14.07	
Mercury	ND	ND	NA	
Selenium	8.00	6.2	25.35	
Silver	0.22	0.23	4.44	

Sample description or location	RSB-16B	RSB-16D		
Sample number	229434	229435		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	5.6	6.5	14.88	
Barium	47	50	6.19	
Cadmium	0.57	0.63	10.00	
Chromium	10	13	26.09	
Lead	95	96	1.05	
Mercury	ND	ND	NA	
Selenium	0.59	0.52	12.61	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-22B	RSB-22D		
Sample number	230346	230347		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	10	12	18.18	
Barium	88	90	2.25	
Cadmium	2.7	2.9	7.14	
Chromium	25	15	50.00	J
Lead	237	247	4.13	
Mercury	ND	ND	NA	
Selenium	0.55	0.94	NA	
Silver	ND	ND	NA	

Sample description or location	RSB-29B	RSB-29D		
Sample number	228726	228727		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	11	12	8.70	
Barium	97	99	2.04	
Cadmium	2.5	1.9	27.27	
Chromium	17	21	21.05	
Lead	350	278	22.93	
Mercury	ND	ND	NA	
Selenium	0.86	0.82	4.76	
Silver	ND	ND	NA	

Sample description or location	RSB-33B	RSB-33D		
Sample number	230335	230336		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	10	12	18.18	
Barium	163	146	11.00	
Cadmium	0.54	ND	NA	
Chromium	18	99	138.46	J
Lead	22	21	4.65	
Mercury	ND	ND	NA	
Selenium	1.80	2.4	28.57	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-36B	RSB-36D		
Sample number	228738	228739		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	5.7	6	5.13	
Barium	96	94	2.11	
Cadmium	0.67	0.55	NA	
Chromium	18	15	18.18	
Lead	55	39	34.04	
Mercury	ND	ND	NA	
Selenium	1.10	0.97	12.56	
Silver	ND	ND	NA	

Sample description or location	RSB-37B	RSB-37D		
Sample number	230194	230195		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	13	12	8.00	
Barium	87	64	30.46	
Cadmium	4.2	3.4	NA	
Chromium	10	13	26.09	
Lead	594	570	4.12	
Mercury	ND	ND	NA	
Selenium	1.70	1.1	NA	
Silver	ND	ND	NA	

Sample description or location	RSB-45B	RSB-45D		
Sample number	229222	229223		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	10	4.1	83.69	J
Barium	43	38	12.35	
Cadmium	1.1	0.91	NA	
Chromium	11	7.6	36.56	
Lead	234	172	30.54	
Mercury	ND	ND	NA	
Selenium	0.72	0.56	25.00	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-49C	RSB-49D		
Sample number	230238	230239		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	ND	6.3	NA	
Barium	85	79	7.32	
Cadmium	0.64	0.6	6.45	
Chromium	5.6	11	65.06	J
Lead	186	182	2.17	
Mercury	ND	ND	NA	
Selenium	0.53	1.8	109.01	J
Silver	ND	ND	NA	

Sample description or location	RSB-53B	RSB-53D		
Sample number	230359	230361		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	8.3	9.2	10.29	
Barium	176	137	24.92	
Cadmium	0.58	0.45	25.24	
Chromium	23	27	16.00	
Lead	18	19	5.41	
Mercury	ND	ND	NA	
Selenium	0.93	0.89	4.40	
Silver	ND	ND	NA	

Sample description or location	RSB-55B	RSB-55D		
Sample number	230367	230369		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	359	349	2.82	
Barium	121	92	27.23	
Cadmium	52	52	0.00	
Chromium	12	12	0.00	
Lead	27000	31200	14.43	
Mercury	0.94	0.88	6.59	
Selenium	13.00	14	7.41	
Silver	0.39	0.45	14.29	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-63B	RSB-63D		
Sample number	232818	232819		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	3.4	5.4	NA	
Barium	35	39	10.81	
Cadmium	1.1	1.3	16.67	
Chromium	6.5	9.1	33.33	
Lead	131	154	16.14	
Mercury	ND	ND	NA	
Selenium	ND	0.63	NA	
Silver	ND	ND	NA	

Sample description or location	RSB-73C	RSB-73D		
Sample number	230206	230207		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	7.6	8.1	6.37	
Barium	86	85	1.17	
Cadmium	0.85	1.2	34.15	
Chromium	11	14	24.00	
Lead	178	179	0.56	
Mercury	ND	ND	NA	
Selenium	1.50	1.5	0.00	
Silver	ND	ND	NA	

Sample description or location	RSB-75B	RSB-75D		
Sample number	229939	229940		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	15	18	18.18	
Barium	61	65	6.35	
Cadmium	2	1.7	16.22	
Chromium	8.7	12	31.88	
Lead	1500	1450	3.39	
Mercury	ND	ND	NA	
Selenium	1.20	1.6	28.57	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-76C	RSB-76D		
Sample number	229932	229933		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	7.7	6	24.82	
Barium	114	89	24.63	
Cadmium	ND	ND	NA	
Chromium	18	9.9	58.06	J
Lead	72	78	8.00	
Mercury	ND	ND	NA	
Selenium	0.73	1.4	NA	
Silver	ND	ND	NA	

Sample description or location	RSB-77B	RSB-77D		
Sample number	230180	230182		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	7.7	8.3	7.50	
Barium	45	44	2.25	
Cadmium	1.6	2.6	NA	
Chromium	10	10	0.00	
Lead	2920	1090	91.27	J
Mercury	ND	ND	NA	
Selenium	0.75	1.6	NA	
Silver	ND	ND	NA	

Sample description or location	RSB-80B	RSB-80D		
Sample number	230273	230274		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	7	17	83.33	J
Barium	62	164	90.27	J
Cadmium	ND	0.93	NA	
Chromium	10	27	91.89	J
Lead	23	80	110.68	J
Mercury	ND	ND	NA	
Selenium	0.52	1.4	NA	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSB-85B	RSB-85D		
Sample number	230284	230286		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	6.7	6.6	1.50	
Barium	44	46	4.44	
Cadmium	ND	ND	NA	
Chromium	9.9	9.5	4.12	
Lead	8.2	8.6	4.76	
Mercury	ND	ND	NA	
Selenium	0.59	0.56	5.22	
Silver	ND	ND	NA	

Sample description or location	RSED-2B	RSED-2C		
Sample number	230379	230380		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	229	266	14.95	
Barium	90	85	5.71	
Cadmium	81	80	1.24	
Chromium	27	27	0.00	
Lead	4080	5190	23.95	
Mercury	0.74	0.81	9.03	
Selenium	1.90	2.3	19.05	
Silver	ND	ND	NA	

Sample description or location	RSED-6B	RSED-6C		
Sample number	230599	230600		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	114	91	22.44	
Barium	75	65	14.29	
Cadmium	89	92	3.31	
Chromium	22	19	14.63	
Lead	14800	18600	22.75	
Mercury	0.48	0.41	15.73	
Selenium	6.00	4.1	37.62	
Silver	0.24	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	RSED-9B	RSED-9C		
Sample number	230558	230559		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Arsenic	50	57	13.08	
Barium	115	119	3.42	
Cadmium	23	25	8.33	
Chromium	19	24	23.26	
Lead	14800	17100	14.42	
Mercury	0.17	0.15	12.50	
Selenium	2.40	3.2	28.57	
Silver	ND	0.27	NA	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

APPENDIX B
DATA VALIDATION REPORT FOR CLOSURE SAMPLES

DATA VALIDATION REPORT

OF

CLOSURE INVESTIGATION SOIL SAMPLES

COLLECTED AUGUST 20, 1999

FOR

INORGANIC PARAMETERS

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

Laboratory Case Number
35132-28

PREPARED FOR:

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

PREPARED BY:

ADVANCED GEOSERVICES CORP.
CHADDS FORD, PENNSYLVANIA

FEBRUARY 16, 2000

PROJECT NUMBER 98-478-03

TABLE OF CONTENTS

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1.0	Introduction	1
2.0	Inorganic Data Validation	2
	2.1 General	2
	2.2 Qualifications	2
3.0	Conclusion	3

TABLE

Metals Data Summary Table

ATTACHMENT

Metals Data Support Documentation

1.0 INTRODUCTION

Soil samples were collected at the Refined Metals Corporation (RMC) Site in Beech Grove, Indiana, between August 10 and September 1, 1999 for chemical analyses as part of the RMC Closure Investigation. Four samples were retrieved from archive in December and analyzed for Resource Conservation Recovery Act (RCRA) metals and antimony using SW-846 method 6020 and 7471. Analyses were performed by TriMatrix Laboratories of Grand Rapids, Michigan. The sample results are reported under TriMatrix Case Numbers 35132-28.

The data deliverables consisted of a Report of Analysis listing each sample and result, chain-of-custody records, copies of relevant notebook pages and instrument raw data, calibration information, laboratory blank analysis results, and quality control forms that show precision and accuracy data derived from the quality control samples.

2.0 INORGANIC DATA VALIDATION

All data generated by TriMatrix were reviewed by an Advanced GeoServices Corp. data validation specialist. Validation was performed for holding time compliance, laboratory method blank and field blank contamination, initial and continuing calibration accuracy, matrix spike/matrix spike duplicate (MS/MSD) recovery and precision, field duplicate precision, and detection limit applicability. Inorganic data were validated according to the "USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review" (February 1994) and "Region V Standard Operating Procedures for Validation of CLP Inorganic Data" (September 1993).

Validation was performed to verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. For criteria differences between the functional guidelines and the specific method, the specific method criteria prevailed. Qualifier codes were applied as required. The U qualifier code was applied to all sample results qualitatively questioned due to blank contamination. The U denotes the analyte was not detected at or above the associated instrument detection limit. The J qualifier code was applied to all sample results which are considered quantitative estimates due to exceeding quality control criteria. The UJ qualifier code was applied to all results which were undetected but are estimated due to exceeding quality control criteria. The R qualifier code was applied to all sample results which are considered unusable. Samples may have exceeded several quality control criteria, however, only one qualifier is applied to a result.

2.1 General

Four soil samples were collected, archived then retrieved from archive and analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and antimony by SW-846 method 6020 and 7471. Initial and continuing calibrations were accurate. The laboratory blanks were evaluated for blank contamination. No laboratory blank contamination was present. Laboratory control sample recoveries were within acceptance criteria.

2.2 Qualifications

All mercury results and detection limits are rejected (R). The samples were retrieved from archive and analyzed 3 months after the mercury hold time of 28 days had expired.

Due to silver matrix spike and matrix spike duplicate recoveries outside the acceptance criteria, all silver results and detection limits are estimated (J, UJ). It should also be noted that the contract required detection limit standard recovery was also outside the acceptance criteria.

3.0 CONCLUSION

This data validation has identified exceeding mercury hold time criteria and silver MS/MSD accuracy as reasons for qualifying the metals data. All other data are acceptable as reported by the laboratory. All data requiring qualification have been addressed in this review and are appropriately qualified on the data summary tables. To confidently use any of the analytical results, the data user should understand the qualifications and limitations stated in this report.

QUALIFIER CODES

R - Denotes an unusable result. The analyte may or may not be present.

U - Denotes the analyte is not present at or above the associated detection limit.

J - Denotes an estimated value.

UJ - Denotes an undetected result that is estimated due to exceeding quality control criteria.

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
SOIL SAMPLES COLLECTED
AUGUST 1999

Project Name	Beech Grove		Laboratory	TriMatrix Laboratories
Project Number	98-478-03		Case No.	35132-28
Sample Date(s)	8/20/1999		Method	SW-846 6010B & 7471

Sample Location	CSB-35E			CSB-35F			CSB-51F			CSB-51G		
Lab ID	237903			237902			237904			237905		
Matrix	aqueous			aqueous			aqueous			aqueous		
Units	mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/1999			8/20/1999			8/20/1999			8/20/1999		
Comments												
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	99		1	55		1	182		1	81		1
Arsenic	15		1	12		1	18		1	15		1
Barium	49		1	48		1	55		1	50		1
Cadmium	5.6		0.5	3.2		0.5	6.5		0.5	3.6		0.5
Chromium	9.3		1	10		1	9		1	10		1
Lead	4910		0.6	3010		0.6	8020		0.6	3800		0.6
Mercury		R	0.1		R	0.1		R	0.1		R	0.1
Selenium	1.1		0.5	1.4		0.5	1.4		0.5	1.1		0.5
Silver		UJ	0.2		UJ	0.2	0.28	J	0.2		UJ	0.2

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
R - Denotes an unusable result. The analyte may or may not be present.
U - The analyte was not detected at or above the associated value.
UJ - Denotes an estimated detection limit.
J - Denotes an estimated result.

F:\Oficeage\Common\QA\Refined\BeechGrove\DataValidation\August1999.xls QA Scientist Dave McCann Date 4/16/00

INORGANIC DATA VALIDATION SUMMARY

Site Name: Beech Grove
Project Number: 98-478-03
Sampling Date(s): 8/20/99

Laboratory: Tri Matrix
Case /Order No.: 35132-28

Compound List: ☐ TAL ☐ Priority Pollutant ☐ Appendix IX ☑ Other RCRA

Method: ☐ CLP SOW ILMO4. ☐ 40 CFR 136 ☒ SW-846 Method ☐ Other ______

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times			✓	Hg - digestion took place 3 months outside HT. Results close to DL ∴ R
Initial Calibrations	✓			
Continuing Calibrations	✓			
CRDL Standards			✓	Ag CRDL 150% R
Blank Analysis Results	✓			
ICP Interference Check Sample Recoveries	✓			
Duplicate Results	✓			
Field Duplicate Results		✓		NA
Spike Analysis Recoveries			✓	Ag spk Rs 51 + 57% R
Serial Dilution Results		✓		NA
Laboratory Control Sample Results		✓		Ag low (~50% R) reran w/in criteria
~~Furnace~~ Flame AA QC Analysis		✓		Hg
Quantitation/Detection Limits		✓		Hg results reported < DL, didn't use since rejected results
Overall Assessment of Data	✓			
Other:				

General Comments:

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased
NA - Not applicable.
NR - Not reviewed.

QA Scientist Denise McGuire
Date 2/14/00

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
CRDL STANDARD
USEPA CLP FORM 2B

SDG No.	35132 -28	Matrix	WATER
		Units	ug/L

Analyte	Anlytical Batch	True Value	Amount Found	% Recovery
Antimony, Total	150445	1.0	1.08	108
Arsenic, Total	150445	1.0	1.10	110
Barium, Total	150445	1.0	1.08	108
Cadmium, Total	150445	0.20	0.28	140
Chromium, Total	150445	1.0	1.04	104
Selenium, Total	150445	1.0	0.95	95
Silver, Total	150445	0.20	0.30	150
Lead, Total	150488	1.0	1.07	107
Mercury, Total	150500	0.20	0.21	105
Antimony, Total	150628	1.0	1.11	111

Cd - spk less than DL.
∴ no qualification
based on this

Ag - estimate results.

DLM 2/14/05

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -28	Matrix	SOIL
		Lab Sample No.	237904
Sample ID.	CSB51F	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result	Spike Added	%R	M
Arsenic, Total	73 - 121	147.4	18	125	104	MS
Arsenic, Total	73 - 121	143.8	18	125	101	MS
Barium, Total	69 - 131	176.4	55	125	97	MS
Barium, Total	69 - 131	180.2	55	125	100	MS
Cadmium, Total	83 - 114	31.1	6.5	25.0	98	MS
Cadmium, Total	83 - 114	30.7	6.5	25.0	97	MS
Chromium, Total	69 - 130	129.2	9.0	125	96	MS
Chromium, Total	69 - 130	134.2	9.0	125	100	MS
Selenium, Total	62 - 126	120.3	1.4	125	95	MS
Selenium, Total	62 - 126	124.4	1.4	125	98	MS
Silver, Total	78 - 115	13.1	0.28	25.0	51	MS
Silver, Total	78 - 115	14.6	0.28	25.0	57	MS

Estimate all samples.
DJM 2/14/05

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TriMatrix
Laboratories, Inc.

ANALYSIS-PRETREATMENT DATE SUMMARY PAGE

Advanced GeoServices Corporation
Proj: RMC - Beech Grove, IN

Subm: 8/20/99 Archive Samples
Sample: CSB35F

Submittal Number 35132- 28
Date Sampled: 08/20/99
Date Received: 11/30/99

Sample No: 237902

	Analysis		Pretreatment	
	Run Date	Hold Date	Run Date	Hold Date
Antimony, Total	12/08/99	05/28/00	11/30/99	02/16/00
Arsenic, Total	12/08/99	05/28/00	11/30/99	02/16/00
Barium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Cadmium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Chromium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Lead, Total	12/09/99	05/28/00	11/30/99	02/16/00
Mercury, Total	12/02/99	12/14/99	12/01/99	09/17/99
Digestion Mtd. 245.1/7470 Mercury-Cold Vapor Method	12/01/99	09/17/99		
Acid Digestion of Soils USEPA Method 3050B	11/30/99	02/16/00		
Selenium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Silver, Total	12/08/99	05/28/00	11/30/99	02/16/00

Reject results
Dim 2/14/05

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TriMatrix Laboratories, Inc.

ANALYSIS-PRETREATMENT DATE SUMMARY PAGE

Advanced GeoServices Corporation
Proj: RMC - Beech Grove, IN

Subm: 8/20/99 Archive Samples
Sample: CSB35E

Submittal Number 35132- 28
Date Sampled: 08/20/99
Date Received: 11/30/99

Sample No: 237903

	Analysis Run Date	Analysis Hold Date	Pretreatment Run Date	Pretreatment Hold Date
Antimony, Total	12/14/99	05/28/00	11/30/99	02/16/00
Arsenic, Total	12/08/99	05/28/00	11/30/99	02/16/00
Barium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Cadmium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Chromium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Lead, Total	12/09/99	05/28/00	11/30/99	02/16/00
Mercury, Total	12/02/99	12/14/99	12/01/99	09/17/99
Digestion Mtd. 245.1/7470 Mercury-Cold Vapor Method	12/01/99	09/17/99		
Acid Digestion of Soils USEPA Method 3050B	11/30/99	02/16/00		
Selenium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Silver, Total	12/08/99	05/28/00	11/30/99	02/16/00

Reject results
2/14/05
DM

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TriMatrix Laboratories, Inc.

ANALYSIS-PRETREATMENT DATE SUMMARY PAGE

Advanced GeoServices Corporation
Proj: RMC - Beech Grove, IN

Submittal Number 35132- 28
Date Sampled: 08/20/99
Date Received: 11/30/99

Subm: 8/20/99 Archive Samples
Sample: CSB51F

Sample No: 237904

	Analysis		Pretreatment	
	Run Date	Hold Date	Run Date	Hold Date
Antimony, Total	12/14/99	05/28/00	11/30/99	02/16/00
Arsenic, Total	12/08/99	05/28/00	11/30/99	02/16/00
Barium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Cadmium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Chromium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Lead, Total	12/09/99	05/28/00	11/30/99	02/16/00
Mercury, Total	12/02/99	12/14/99	12/01/99	09/17/99
Digestion Mtd. 245.1/7470 Mercury-Cold Vapor Method	12/01/99	09/17/99		
Acid Digestion of Soils USEPA Method 3050B	11/30/99	02/16/00		
Selenium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Silver, Total	12/08/99	05/28/00	11/30/99	02/16/00

Reject Hg results DMM 2/14/00

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TriMatrix Laboratories, Inc.

ANALYSIS-PRETREATMENT DATE SUMMARY PAGE

Advanced GeoServices Corporation
Proj: RMC - Beech Grove, IN

Subm: 8/20/99 Archive Samples
Sample: CSB51G

Submittal Number 35132- 28
Date Sampled: 08/20/99
Date Received: 11/30/99

Sample No: 237905

	Analysis		Pretreatment	
	Run Date	Hold Date	Run Date	Hold Date
Antimony, Total	12/14/99	05/28/00	11/30/99	02/16/00
Arsenic, Total	12/08/99	05/28/00	11/30/99	02/16/00
Barium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Cadmium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Chromium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Lead, Total	12/09/99	05/28/00	11/30/99	02/16/00
Mercury, Total	12/02/99	12/14/99	12/01/99	09/17/99
Digestion Mtd. 245.1/7470 Mercury-Cold Vapor Method	12/01/99	09/17/99		
Acid Digestion of Soils USEPA Method 3050B	11/30/99	02/16/00		
Selenium, Total	12/08/99	05/28/00	11/30/99	02/16/00
Silver, Total	12/08/99	05/28/00	11/30/99	02/16/00

Reject Hg results 2/14/00

5560 Corporate Exchange Court SE • Grand Rapids, MI 49512 • (616) 975-4500 • Fax (616) 942-7463

DATA VALIDATION REPORT

OF

CLOSURE INVESTIGATION SOIL SAMPLES

COLLECTED BETWEEN AUGUST 10 AND SEPTEMBER 1, 1999

FOR

INORGANIC PARAMETERS

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

Laboratory Case Number
35132-4, 5, 6, 8, 9, 13, 15, 16, 20, 21, and 35132-27

PREPARED FOR:

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

PREPARED BY:

ADVANCED GEOSERVICES CORP.
CHADDS FORD, PENNSYLVANIA

DECEMBER 20, 1999

PROJECT NUMBER 98-478-03

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Wet Chemistry Data Support Documentation

1.0 INTRODUCTION

Soil and sediment samples were collected at the Refined Metals Corporation (RMC) Site in Beech Grove, Indiana, between August 10 and September 1, 1999 for chemical analyses as part of the RMC Closure Investigation. The samples were analyzed for Resource Conservation Recovery Act (RCRA) metals, antimony, and pH. Several field duplicates and equipment blanks were also collected and analyzed. Analyses were performed by TriMatrix Laboratories of Grand Rapids, Michigan. The sample results are reported under TriMatrix Case Numbers 35132-4, 5, 6, 8, 9, 13, 15, 16, 20, 21, and 35132-27.

The samples were analyzed for the following parameters by the corresponding methodologies:

Analytical Parameter	Methodology
RCRA Metals and Antimony	SW-846 Method 6020/7471
pH	EPA Method 9045C

The data deliverables consisted of a Report of Analysis listing each sample and result, chain-of-custody records, copies of relevant notebook pages and instrument raw data, calibration information, laboratory blank analysis results, and quality control forms that show precision and accuracy data derived from the quality control samples.

Field duplicate samples can be identified by the "D" after the sample number. The duplicate samples correspond with the sample letter preceding the "D." For example, the sample CSB-4B has a corresponding field duplicate sample of CSB-4BD.

2.0 INORGANIC DATA VALIDATION

All data generated by TriMatrix were reviewed by an Advanced GeoServices Corp. data validation specialist. Validation was performed for holding time compliance, laboratory method blank and field blank contamination, initial and continuing calibration accuracy, matrix spike/matrix spike duplicate (MS/MSD) recovery and precision, field duplicate precision, and detection limit applicability. Inorganic data were validated according to the "USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Inorganic Data Review" (February 1994) and "Region V Standard Operating Procedures for Validation of CLP Inorganic Data" (September 1993).

Validation was performed to verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. For criteria differences between the functional guidelines and the specific method, the specific method criteria prevailed. Qualifier codes were applied as required. The U qualifier code was applied to all sample results qualitatively questioned due to blank contamination. The U denotes the analyte was not detected at or above the associated instrument detection limit. The J qualifier code was applied to all sample results which are considered quantitative estimates due to exceeding quality control criteria. The UJ qualifier code was applied to all results which were undetected but are estimated due to exceeding quality control criteria. Samples may have exceeded several quality control criteria, however, only one qualifier is applied to a result.

2.1 Metals Data

2.1.1 General

168 soil samples, 5 sediment samples, 17 field duplicate samples, and 43 equipment blanks were collected and analyzed for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and antimony by SW-846 method 6020, 7470, and 7471. All holding times were within the EPA method requirements. Initial and continuing calibrations were accurate. Laboratory control sample recoveries were within acceptance criteria.

2.1.2 Qualifications

According to Region V criteria, when applying qualification based on blank contamination, results which are greater than the instrument detection limit (IDL) but less than five times the Contract Required Detection Limit ©
RDL) are qualified using the following criteria: results less than five times the blank concentration are qualified with the U qualifier code and results greater than five times the blank concentration are qualified with the J qualifier code.

Due to the presence of antimony in associated method blanks, the following sample antimony results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

CSB-3E (235314)	CSB-7D (235315)	CSB-7E (235316)
CSB-10D (235317)	CSB-15A (229763)	CSB-15B (229764)
CSB-15C (229765)	CSB-15CD (229766)	CSB-14A (229768)
CSB-14C (229770)	CSB-8C (229774)	CSB-16A (229776)
CSB-16B (229777)	CSB-16C (229778)	CSB-17A (229780)
CSB-17B (229781)	CSB-17C (229782)	CSB-17CD (229783)
CSB-20A(229785)		

Due to the presence of chromium in an associated method blank, the following sample chromium results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

CSB-31C (230316)	CSB-24A (230319)	CSB-24B (230320)
CSB-24C (230321)	CSB-23A (230322)	CSB-23B (230323)
CSB-23C (230324)	CSB-23CD (230325)	CSB-22B (230328)
CSB-22C (230329)		

Due to the presence of lead in associated method blanks and equipment blanks, the following sample lead results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

CSB-4C (229461)	CSB-5B (229472)	CSB-5C (229473)
CSB-6B (229476)	CSB-6C (229477)	CSB-9C (229484)
CSB-9CD (229485)	CSB-13B (229488)	CSB-13C (229489)
CSB-38B (229945)	CSB-38C (229946)	CSB-38CD (229947)
CSB-49B (229954)	CSB-49C (229955)	CSB-45C (230565)
CSB-47B (230567)	CSB-47C (230568)	CSB-15A (229763)
CSB-14B (229769)	CSB-14C (229770)	CSB-20B (229786)
CSB-14A (229768)	CSB-26B (230260)	CSB-39C (229984)
CSB-39CD (229985)	CSB-40B (229988)	CSB-40C (229989)
CSB-41B (229991)	CSB-41C (229992)	CSB-42A (229978)
CSB-42B (229979)	CSB-42C (229980)	

Due to the presence of mercury in the equipment blank EQ-8 (229453), the following sample mercury results are qualitatively questioned. The U qualifier code is applied to reflect an elevated detection limit.

CSB-3A (229454)	CSB-3B (229455)	CSB-3C (229456)
CSB-3D (235313)		

Due to duplicate injection precision outside the acceptance limit of 20% relative standard deviation (RSD), the selenium results for the following samples are estimated (J):

CSB-9B (229483)	CSB-11C (229498)	CSB-13A (229487)
CSB-13B (229488)	CSB-13C (229489)	CSB-9C (229484)
CSB-34A (229956)	CSB-49A (229953)	CSB-51A (229949)
CSB-47A (230506)	CSB-43A (230577)	BSB-2B (230761)
CSB-25A (230246)	CSB-25B (230247)	CSB-27B (230251)
CSB-19B (230264)	CSB-19C (230265)	CSB-50C (230256)
CSB-26A (230259)		

Due to mercury MS/MSD percent recoveries (%Rs) outside the upper acceptance criteria (75-125), the detected results are estimated (J) for the following samples: BSB-2A (230760), CSED-4A (230587), and CSB-8A (229772).

Due to lead and silver MS/MSD %R exceeding acceptance limits, the following sample lead and silver results and detection limits are estimated (J, UJ):

CSB-3A (229454)	CSB-3B (229455)	CSB-3C (229456)
CSB-4A (229458)	CSB-4B (229459)	CSB-4BD (229460)
CSB-1A (229463)	CSB-1B (229464)	CSB-1C (229465)
CSB-7A (229466)	CSB-7B (229467)	CSB-6A (229475)
CSB-5A (229471)	CSB-7C (229468)	CSB-7CD (229469)

Due to MS/MSD %Rs outside control limits, the following samples silver detection limits were estimated (UJ):

CSB-4C (229461)	CSB-5B (229472)	CSB-5C (229473)
CSB-6B (229476)	CSB-6C (229477)	

Due to arsenic, barium , lead, and selenium MS/MSD relative percent differences (RPDs) outside acceptance criteria, sample CSB-38A (229944) arsenic, barium, lead, and selenium results and detection limits are estimated (J).

Due to lead MS/MSD accuracy and precision outside acceptance criteria, the following sample lead results are estimated (J):

CSB-18C (230269)	CSB-35B (229970)	CSB-35C (229972)
CSB-35CD (229971)	CSB-37A (229974)	CSB-37B (229975)
CSB-37C (229976)	CSB-39A (229982)	CSB-39B (229983)
CSB-40A (229987)	CSB-41A (229990)	

Due to arsenic and selenium MS/MSD accuracy and precision outside acceptance criteria, the following sample arsenic and selenium results and detection limits are estimated (J, UJ):

CSB-31C (230316)	CSB-24A (230319)	CSB-24B (230320)
CSB-24C (230321)	CSB-23A (230322)	CSB-23C (230324)
CSB-23CD (230325)	CSB-22A (230327)	CSB-22B (230328)
CSB-22C (230329)	CSB-23B (230323)	

Due to barium, lead, and silver MS/MSD %Rs outside the lower acceptance criteria, the following sample barium, lead, and silver results and detection limits are estimated (J, UJ):

CSB-21A (230293)	CSB-21B (230294)	CSB-21C (230295)
CSB-28A (230297)	CSB-28B (230298)	CSB-28C (230299)
CSB-28CD (230300)	CSB-29A (230302)	CSB-29B (230303)
CSB-29C (230304)	CSB-30A (230305)	CSB-30B (230306)
CSB-30C (230307)	CSB-30CD (230308)	CSB-32A (230310)
CSB-32C (230312)	CSB-32B (230311)	CSB-31A (230314)
CSB-31B (230315)		

Field duplicate samples were evaluated based on duplicate precision. A control limit of $\pm$ 40% was used for original and duplicate sample values greater than or equal to 5 times the CRDL. A control limit of $\pm$ 2 times the CRDL was used if either the sample or duplicate result was less than the CRDL.

Due to poor field duplicate precision, the following sample lead results are qualified as estimated (J):

CSB-16A (229776)	CSB-16B (229777)	CSB-16C (229778)
CSB-17A (229780)	CSB-17B (229781)	CSB-17C (229782)
CSB-17CD (229783)	CSB-20A (229785)	CSB-20C (229787)
CSB-22A (230327)	CSB-22B (230328)	CSB-22C (230329)
CSB-23A (230322)	CSB-23B (230323)	CSB-23C (230324)
CSB-23CD (230325)	CSB-24A (230319)	CSB-24B (230320)
CSB-24C (230321)	CSB-3D (235313)	CSB-3E (235314)
CSB-43A (230577)	CSB-43B (230578)	CSB-43C (230579)
CSB-44A (230572)	CSB-44B (230573)	CSB-44C (230574)
CSB-44CD (230575)	CSB-46A (230580)	CSB-46B (230581)
CSB-46C (230582)	CSB-18A (230267)	CSB-18B (230268)
CSB-19A (230263)	CSB-19B (230264)	CSB-19C (230265)
CSB-19CD (230266)	CSB-26A (230259)	CSB-26C (230261)

Due to poor field duplicate precision, the following sample arsenic, chromium, and selenium results are qualified as estimated (J):

CSB-21A (230293)	CSB-21B (230294)	CSB-21C (230295)
CSB-28A (230297)	CSB-28B (230298)	CSB-28C (230299)
CSB-28CD (230300)	CSB-29A (230302)	CSB-29B (230303)
CSB-29C (230304)		

Due to poor field duplicate precision, the following sample antimony results are qualified as estimated (J):

CSB-30A (230305)	CSB-30B (230306)	CSB-30C (230307)
CSB-30CD (230308)		

Due to poor field duplicate precision, the following sample arsenic results are qualified as estimated (J):

CSB-39A (229982)	CSB-39B (229983)	CSB-39C (229984)
CSB-39CD (229985)	CSB-40A (229987)	CSB-40B (229988)

Due to poor field duplicate precision, the following sample arsenic results are qualified as estimated (J):

CSB-39A (229982)	CSB-39B (229983)	CSB-39C (229984)
CSB-39CD (229985)	CSB-40A (229987)	CSB-40B (229988)
CSB-40C (229989)	CSB-41A (229990)	CSB-41B (229991)
CSB-41C (229992)		

Due to poor field duplicate precision, the following sample antimony, arsenic, cadmium and chromium results are qualified as estimated (J):

CSB-1A (229463)	CSB-1B (229464)	CSB-1C (229465)
CSB-3A (229454)	CSB-3B (229455)	CSB-3C (229456)
CSB-3D (235313)	CSB-3E (235314)	CSB-4A (229458)
CSB-4B (229459)	CSB-4BD (229460)	CSB-4C (229461)

Due to poor field duplicate precision, the following sample antimony, arsenic and lead results are qualified as estimated (J):

CSB-10A (229491)	CSB-10B (229492)	CSB-10C (229493)
CSB-10CD (229494)	CSB-11A (229496)	CSB-11B (229497)
CSB-11C (229498)	CSB-12A (229499)	CSB-12B (229500)
CSB-12C (229501)	CSB-10D (235317)	

Due to poor field duplicate precision, the following sample barium, chromium, and lead results are qualified as estimated (J):

CSB-25A (230246)	CSB-25B (230247)	CSB-25C (230248)
CSB-27A (230250)	CSB-27B (230251)	CSB-27C (230252)
CSB-50A (230254)	CSB-50B (230255)	CSB-50C (230256)
CSB-50CD (230257)		

CSB-40C (229989)	CSB-41A (229990)	CSB-41B (229991)
CSB-41C (229992)		

Due to poor field duplicate precision, the following sample antimony, arsenic, cadmium and chromium results are qualified as estimated (J):

CSB-1A (229463)	CSB-1B (229464)	CSB-1C (229465)
CSB-3A (229454)	CSB-3B (229455)	CSB-3C (229456)
CSB-3D (235313)	CSB-3E (235314)	CSB-4A (229458)
CSB-4B (229459)	CSB-4BD (229460)	CSB-4C (229461)

Due to poor field duplicate precision, the following sample antimony, arsenic and lead results are qualified as estimated (J):

CSB-10A (229491)	CSB-10B (229492)	CSB-10C (229493)
CSB-10CD (229494)	CSB-11A (229496)	CSB-11B (229497)
CSB-11C (229498)	CSB-12A (229499)	CSB-12B (229500)
CSB-12C (229501)	CSB-10D (235317)	

Due to poor field duplicate precision, the following sample barium, chromium, and lead results are qualified as estimated (J):

CSB-25A (230246)	CSB-25B (230247)	CSB-25C (230248)
CSB-27A (230250)	CSB-27B (230251)	CSB-27C (230252)
CSB-50A (230254)	CSB-50B (230255)	CSB-50C (230256)
CSB-50CD (230257)		

2.2 pH Data

2.2.1 General

101 samples were analyzed for pH by SW-846 method 9045C. Initial and continuing calibrations were accurate. The laboratory control sample was accurate. Laboratory duplicates and field duplicate results were within control criteria. Blank results were accurate.

2.2 Wet Chemistry Data

2.2.1 General

101 samples were analyzed for pH by SW-846 method 9045C. Initial and continuing calibrations were accurate. The laboratory control sample was accurate. Laboratory duplicates and field duplicate results were within control criteria. Blank results were accurate.

2.2.2 Qualifications

All pH results are estimated (J) due to exceeding the holding time criteria of 24 hours. pH analysis should be performed immediately upon sample collection for the most accurate results. The pH analyses of these samples were performed two or three days after sample collection.

3.0 CONCLUSION

This data validation has identified method and equipment blank contamination, duplicate injection precision, MS/MSD precision and accuracy, and field duplicate precision as reasons for qualifying the metals data. Exceeding holding time criteria was identified as the reason for estimating all pH results. All other data are acceptable as reported by the laboratory. All data requiring qualification have been addressed in this review and are appropriately qualified on the data summary tables. To confidently use any of the analytical results, the data user should understand the qualifications and limitations stated in this report.

QUALIFIER CODES

U - Denotes the analyte is not present at or above the associated detection limit.

J - Denotes an estimated value.

UJ - Denotes an undetected result that is estimated due to exceeding quality control criteria.

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Sample Date(s)	8/10-8/26, 9/1/99	Method	SW-846 6010B, 7470 & 7471

Sample Location	BSB-1A			BSB-1B			BSB-1C			BSB-2A			BSB-2B			BSB-3A			BSB-3B		
Lab ID	230762			230763			230764			230760			230761			230765			230766		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/26/99			8/26/99			8/26/99			8/26/99			8/26/99			8/26/99			8/26/99		
Comments																					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	4.3		1.0	1.8		1.0	5.8		1.0	26		1.0	2.5		1.0	4.0		1.0		U	1.0
Arsenic	5.5		1.0	5.9		1.0	10		1.0	13		1.0	5.1		1.0	7.0		1.0	5.4		1.0
Barium	66		1.0	87		1.0	85		1.0	53		1.0	57		1.0	98		1.0	95		1.0
Cadmium	0.77		0.50		U	0.50	1.4		0.50	3.5		0.50		U	0.50	1.3		0.50		U	0.50
Chromium	15		1.0	20		1.0	12		1.0	9.6		1.0	11		1.0	16		1.0	18		1.0
Lead	158		0.60	63		0.60	262		0.60	1200		0.60	74		0.60	257		0.60	20		0.60
Mercury		U	0.10		U	0.10		U	0.10	0.11	J	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.98		0.50	0.92		0.50	2.6		0.50	0.97		0.50	0.53	J	0.50	1.3		0.50	1.0		0.50
Silver		U	0.20		U	0.20	1.5		0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	BSB-4A			BSB-4B			CSB-1A			CSB-1B			CSB-1C			CSB-2A			CSB-2B			CSB-2C		
Lab ID	230767			230768			229463			229464			229465			229479			229480			229481		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/26/99			8/26/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99		
Comments																								
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	44		1.0	34		1.0	1110	J	1.0	5390	J	1.0	19	J	1.0	1320		1.0	523		1.0	1860		1.0
Arsenic	16		1.0	12		1.0	406	J	1.0	599	J	1.0	8.0	J	1.0	266		1.0	159		1.0	469		1.0
Barium	279		1.0	276		1.0	148		1.0	251		1.0	56		1.0	210		1.0	136		1.0	264		1.0
Cadmium	3.3		0.50	2.2		0.50	94	J	0.50	148	J	0.50	3.3	J	0.50	99		0.50	70		0.50	98		0.50
Chromium	34		1.0	25		1.0	6.9	J	1.0	8.0	J	1.0	9.0	J	1.0	9.3		1.0	11		1.0	12		1.0
Lead	1060		0.60	690		0.60	139000	J	0.60	268000	J	0.60	511	J	0.60	175000		0.60	58400		0.60	180000		0.60
Mercury		U	0.10		U	0.10	0.52		0.10	2.0		0.10		U	0.10	0.53		0.10	0.19		0.10	0.64		0.10
Selenium	0.76		0.50		U	0.50	42		0.50	72		0.50	0.63		0.50	10		0.50	2.7		0.50	27		0.50
Silver	0.34		0.20	0.31		0.20	1.9	J	0.20	3.2	J	0.20		UJ	0.20	0.90		0.20	0.29		0.20	1.7		0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	*8/10-8/26, 9/1/99*
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-3A			CSB-3B			CSB-3C			CSB-3D			CSB-3E			CSB-4A			CSB-4B			CSB-4BD			CSB-4C			CSB-5A		
Lab ID	229454			229455			229456			235313			235314			229458			229459			229460			229461			229471		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99		
Comments																						FD of CSB-4B								
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1880	J	1.0	2360	J	1.0	1510	J	1.0	1270	J	1.0	9.7	U	1.0	2400	J	1.0	1000	J	1.0	34	J	1.0	3.2	J	1.0	6.4		1.0
Arsenic	284	J	1.0	565	J	1.0	217	J	1.0	193	J	1.0	12	J	1.0	690	J	1.0	164	J	1.0	25	J	1.0	6.8	J	1.0	7.2		1.0
Barium	123		1.0	160		1.0	174		1.0	158		1.0	146		1.0	266		1.0	123		1.0	158		1.0	76		1.0	66		1.0
Cadmium	124	J	0.50	167	J	0.50	68	J	0.50	57	J	0.50		UJ	0.50	138	J	0.50	102	J	0.50	29	J	0.50		UJ	0.50		U	0.50
Chromium	9.8	J	1.0	8.4	J	1.0	12	J	1.0	17	J	1.0	27	J	1.0	14	J	1.0	13	J	1.0	30	J	1.0	14	J	1.0	13		1.0
Lead	121000	J	0.60	150000	J	0.60	78100	J	0.60	93900	J	0.60	232	J	0.60	192000	J	0.60	460000	J	0.60	2450	J	0.60	65	U	0.60	125	J	0.60
Mercury	0.56	U	0.1	3.7	U	0.10	0.33	U	0.10	0.48	U	0.1		U	0.10	0.70		0.10	0.23		0.10		U	0.10		U	0.10		U	0.10
Selenium	22		0.50	38		0.50	24		0.50	20		0.50	1.8		0.50	36		0.50	1.9		0.50	1.2		0.50	0.61		0.50		U	0.50
Silver	0.98	J	0.20	0.50	J	0.20	0.66	J	0.20	1.4		0.20		U	0.20	2.5	J	0.20	0.50	J	0.20		UJ	0.20		UJ	0.20		UJ	0.20

Sample Location	CSB-5B			CSB-5C			CSB-6A			CSB-6B			CSB-6C			CSB-7A			CSB-7B			CSB-7C			CSB-7CD			CSB-7D		
Lab ID	229472			229473			229475			229476			229477			229466			229467			229468			229469			235315		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99		
Comments																									FD of CSB-7C					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	3.0		1.0	1.2		1.0	13		1.0	2.0		1.0	3.9		1.0	826		1.0	2070		1.0	904		1.0	1140		1.0	6.5	U	1.0
Arsenic	7.1		1.0	5.1		1.0	8.9		1.0	9.6		1.0	11		1.0	81		1.0	788		1.0	343		1.0	430		1.0	6.9		1.0
Barium	79		1.0	74		1.0	67		1.0	85		1.0	76		1.0	39		1.0	207		1.0	134		1.0	113		1.0	44		1.0
Cadmium		U	0.50		U	0.50	0.51		0.50		U	0.50		U	0.50	20		0.50	163		0.50	158		0.50	163		0.50	0.61		0.50
Chromium	14		1.0	15		1.0	11		1.0	18		1.0	22		1.0	14		1.0	18		1.0	16		1.0	12		1.0	8.7		1.0
Lead	67	U	0.60	42	U	0.60	165	J	0.60	50	U	0.60	69	U	0.60	255000	J	0.60	154000	J	0.60	77200	J	0.60	144000	J	0.60	114		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	2.9		0.10	0.87		0.10	0.73		0.10	0.61		0.10		U	0.10
Selenium	0.53		0.50		U	0.50	1.6		0.50	0.52		0.50	0.62		0.50	20		0.50	9.4		0.50	12		0.50	9.9		0.50		U	0.50
Silver		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20	11	J	0.20	1.7	J	0.20	1.5	J	0.20	1.9	J	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-7E			CSB-8A			CSB-8B			CSB-8C			CSB-9A			CSB-9B			CSB-9C			CSB-9CD			CSB-10A			CSB-10B		
Lab ID	235316			229772			229773			229774			229482			229483			229484			229485			229491			229492		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/17/99			8/19/99			8/19/99			8/19/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99		
Comments																						FD of CSB-9C								
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	5.0	U	1.0	486		1.0	38		1.0	13	U	1.0	6.9		1.0	2.2		1.0	1.2		1.0	4.3		1.0	1280	J	1.0	3040	J	1.0
Arsenic	6.2		1.0	66		1.0	10		1.0	10		1.0	12		1.0	11		1.0	7.7		1.0	7.4		1.0	709	J	1.0	916	J	1.0
Barium	45		1.0	101		1.0	62		1.0	39		1.0	84		1.0	206		1.0	76		1.0	69		1.0	197		1.0	308		1.0
Cadmium		U	0.50	12		0.50	2.5		0.50	1.2		0.50		U	0.50	8.5		0.50		U	0.50		U	0.50	225		0.50	1080		0.50
Chromium	8.4		1.0	5.6		1.0	13		1.0	9.5		1.0	20		1.0	26		1.0	13		1.0	12		1.0	14		1.0	9.6		1.0
Lead	19	U	0.60	83800		0.60	989		0.60	279		0.60	289		0.60	132		0.60	53	U	0.60	50	U	0.60	132000	J	0.60	23600	J	0.60
Mercury		U	0.10	0.51	J	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	1.3		0.10	1.4		0.10
Selenium	0.63		0.50	7.4		0.50	0.80		0.50	0.65		0.50	0.91		0.50	1.2	J	0.50	0.71	J	0.50	0.73		0.50	62		0.5	111		0.5
Silver		U	0.20	1.1		0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20	1		0.2	1.8		0.2

Sample Location	CSB-10C			CSB-10CD			CSB-10D			CSB-11A			CSB-11B			CSB-11C			CSB-12A			CSB-12B			CSB-12C			CSB-13A		
Lab ID	229493			229494			235317			229496			229497			229498			229499			229500			229501			229487		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99			8/17/99		
Comments				FD of CSB-10C																										
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	43	J	1.0	4.9	J	1.0	16	U	1.0	1300	J	1.0	2420	J	1.0	28	J	1.0	9600	J	1.0	7610	J	1.0	15	J	1.0	94		1.0
Arsenic	17	J	1.0	8.7	J	1.0	6.9	J	1.0	237	J	1.0	585	J	1.0	14	J	1.0	1050	J	1.0	2270	J	1.0	14	J	1.0	38		1.0
Barium	138		1.0	96		1.0	99		1.0	194		1.0	146		1.0	173		1.0	30		1.0	435		1.0	202		1.0	212		1.0
Cadmium	151		0.50	156		0.50		U	0.50	86		0.50	151		0.50	3.4		0.50	313		0.50	421		0.50	0.94		0.50	19		0.50
Chromium	20		1.0	15		1.0	19		1.0	13		1.0	15		1.0	19		1.0	5.6		1.0	7.7		1.0	21		1.0	25		1.0
Lead	1500	J	0.60	362	J	0.60	548	J	0.60	104000	J	0.60	351000	J	0.60	522	J	0.60	467000	J	0.60	372000	J	0.60	353	J	0.60	323		0.60
Mercury			0.10		U	0.10		U	0.10	0.57		0.10	0.75		0.10		U	0.10	2.9		0.10	3.8		0.10		U	0.10		U	0.10
Selenium	1.6		0.5	0.98		0.5	1.4		0.50	16		0.5	367		0.5	1.9	J	0.50	94		0.50	5.6		0.50	1.9		0.50	0.85	J	0.50
Silver		U	0.2		U	0.2		U	0.20	1		0.2	5		0.2		U	0.20	3.0		0.20	4.0		0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-13B			CSB-13C			CSB-14A			CSB-14B			CSB-14C			CSB-15A			CSB-15B			CSB-15C			CSB-15CD			CSB-16A		
Lab ID	229488			229489			229768			229769			229770			229763			229764			229765			229766			229776		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/17/99			8/17/99			8/19/99			8/19/99			8/19/99			8/19/99			8/19/99			8/19/99			8/19/99			8/19/99		
Comments																									FD of CSB-15C					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	7.8		1.0	2.2		1.0	1.4	U	1.0		U	1.0	1.0	U	1.0	1.5	U	1.0	2.9	U	1.0	2.3	U	1.0	3.3	U	1.0	2.4	U	1.0
Arsenic	11		1.0	10		1.0	2.2		1.0	5.7		1.0	6.4		1.0	7.0		1.0	7.8		1.0	5.3		1.0	6.1		1.0	6.0		1.0
Barium	122		1.0	120		1.0	85		1.0	53		1.0	69		1.0	48		1.0	50		1.0	47		1.0	51		1.0	166		1.0
Cadmium	26		0.50	199		0.50		U	0.50		U	0.50		U	0.50	0.64		0.50	1.3		0.50		U	0.50		U	0.50		U	0.50
Chromium	22		1.0	19		1.0	12		1.0	9.6		1.0	11		1.0	9.9		1.0	12		1.0	9.6		1.0	12		1.0	16		1.0
Lead	30	U	0.60	49	U	0.60	28	U	0.6	9.8	U	0.6	18	U	0.6	9.6	U	0.60	89		0.60	28		0.60	30		0.60	209	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.74	J	0.50	0.83	J	0.50		U	0.50		U	0.50		U	0.50	0.78		0.50		U	0.50		U	0.50		U	0.50	0.92		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-16B			CSB-16C			CSB-17A			CSB-17B			CSB-17C			CSB-17CD			CSB-18A			CSB-18B			CSB-18C			CSB19-A		
Lab ID	229777			229778			229780			229781			229782			229783			230267			230268			230269			230263		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/19/99			8/19/99			8/19/99			8/19/99			8/19/99			8/19/99			8/23/99			8/23/99			8/23/99			8/23/99		
Comments																FD of CSB-17C														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.8	U	1.0	3.2	U	1.0	1.3	U	1.0	1.1	U	1.0	1.2	U	1.0	1.2	U	1.0	1.2		1.0			1.0	1.0		1.0	6.0		1.0
Arsenic	7.2		1.0	7.5		1.0	7.3		1.0	7.1		1.0	6.9		1.0	7.0		1.0	7.8		1.0	6.0		1.0	8.3		1.0	9.0		1.0
Barium	69		1.0	58		1.0	62		1.0	77		1.0	53		1.0	55		1.0	67		1.0	63		1.0	58		1.0	65		1.0
Cadmium		U	0.50	0.53		0.50		U	0.50		U	0.50	0.52		0.50		U	0.50	1.1		0.50	0.63		0.50	0.71		0.50	1.7		0.50
Chromium	11		1.0	11		1.0	11		1.0	14		1.0	11		1.0	10		1.0	12		1.0	12		1.0	12		1.0	13		1.0
Lead	195	J	0.60	234	J	0.60	87	J	0.60	20	J	0.60	101	J	0.60	273	J	0.60	70	J	0.60	26	J	0.60	38	J	0.60	187	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	0.32		0.10		U	0.10		U	0.10		U	0.10
Selenium		U	0.50		U	0.50	0.63		0.50		U	0.50	0.59		0.50	0.65		0.50	0.64		0.50		U	0.50		U	0.50	1.3		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Sample Date(s)	8/10-8/26, 9/1/99	Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-19B			CSB-19C			CSB-19CD			CSB-20A			CSB-20B			CSB-20C			CSB-21A			CSB-21B			CSB-21C			CSB-22A		
Lab ID	230264			230265			230266			229785			229786			229787			230293			230294			230295			230327		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/19/99			8/19/99			8/19/99			8/23/99			8/23/99			8/23/99			8/24/99		
Comments							*FD of CSB-19C*																							
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	6.6		1.0	1.4		1.0	2.2		1.0	1.8	U	1.0		U	1		U	1.0		U	1.0	1.3		1.0		U	1.0		U	1.0
Arsenic	6.8		1.0	6.7		1.0	6.8		1.0	9.6		1.0	6.9		1.0	2.4		1.0	7.8	J	1.0	9.3	J	1.0	6.8	J	1.0	6.3	J	1.0
Barium	61		1.0	47		1.0	53		1.0	73		1.0	64		1.0	41		1.0	204	J	1.0	152	J	1.0	56	J	1.0	56		1.0
Cadmium	0.79		0.50	1.3		0.50	0.66		0.50	1.4		0.50		U	0.50		U	0.50	0.68		0.50	1.3		0.50	1.2		0.50		U	0.50
Chromium	15		1.0	11		1.0	12		1.0	11		1.0	11		1.0	6.6		1.0	18	J	1.0	16	J	1.0	9.2	J	1.0	50		1.0
Lead	79	J	0.60	129	J	0.60	68	J	0.60	30	J	0.60	19	U	0.60	23	J	0.60	31	J	0.60	329	J	0.60	32	J	0.60	8.0	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	1.6	J	0.50	1.4	J	0.50	0.75		0.50	1.0		0.50		U	0.50		U	0.50		UJ	0.50	0.66	J	0.50		UJ	0.50	0.58	J	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		UJ	0.20		UJ	0.20		UJ	0.20		U	0.20

Sample Location	CSB-22B			CSB-22C			CSB-23A			CSB-23B			CSB-23C			CSB-23CD			CSB-24A			CSB-24B			CSB-24C			CSB-25A		
Lab ID	230328			230329			230322			230323			230324			230325			230319			230320			230321			230246		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/24/99			8/23/99		
Comments																FD of CSB-23C														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	4.0		1.0	3.8		1.0	1.3		1.0		U	1.0	1.0		1.0		U	1.0		U	1.0	5.5		1.0		U	1.0	9.1		1.0
Arsenic	6.7	J	1.0	6.6	J	1.0	7.5	J	1.0	7.0	J	1.0	6.2	J	1.0	6.1	J	1.0	4.8	J	1.0	9.3	J	1.0	4.4	J	1.0	13		1.0
Barium	59		1.0	62		1.0	89		1.0	248		1.0	42		1.0	44		1.0	83		1.0	101		1.0	116		1.0	43	J	1.0
Cadmium		U	0.50		U	0.50		U	0.50	0.66		0.50		U	0.50		U	0.50		U	0.50		U	0.50		U	0.50	3.9		0.50
Chromium	10	U	1.0	9.3	U	1.0	12	U	1.0	9.1	U	1.0	8.0	U	1.0	8.3	U	1.0	12	U	1.0	22	U	1.0	17	U	1.0	13	J	1.0
Lead	7.7	J	0.60	9.8	J	0.60	10	J	0.60	11	J	0.60	32	J	0.60	8.0	J	0.60	28	J	0.60	20	J	0.60	12	J	0.60	411	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.57	J	0.50	0.72	J	0.50	0.78	J	0.50	0.75	J	0.50		UJ	0.50	0.62	J	0.50	0.55	J	0.50	1.1	J	0.50	0.92	J	0.50	2.3	J	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-25B			CSB-25C			CSB-26A			CSB-26B			CSB-26C			CSB-27A			CSB-27B			CSB-27C			CSB-28A			CSB-28B		
Lab ID	230247			230248			230259			230260			230261			230250			230251			230252			230297			230298		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99		
Comments																														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	57		1.0	3.4		1.0	4.6		1.0	6.1		1.0	4.1		1.0	3.3		1.0		U	1.0		U	1.0		U	1.0		U	1.0
Arsenic	75		1.0	8.8		1.0	7.7		1.0	6.5		1.0	8.6		1.0	6.3		1.0	8.5		1.0	6.4		1.0	4.4	J	1.0	10	J	1.0
Barium	40	J	1.0	46	J	1.0	47		1.0	46		1.0	48		1.0	46	J	1.0	22	J	1.0	20	J	1.0	65	J	1.0	164	J	1.0
Cadmium	26		0.50	0.89		0.50	1.6		0.50	0.76		0.50	6.7		0.50		U	0.50		U	0.50		U	0.50		U	0.50		U	0.50
Chromium	8.5	J	1.0	8.7	J	1.0	12		1.0	9.7		1.0	11		1.0	9.4	J	1.0	5.8	J	1.0	5.7	J	1.0	10	J	1.0	29	J	1.0
Lead	2420	J	0.60	108	J	0.60	191	J	0.60	73	U	0.6	583	J	0.60	22	J	0.60	13	J	0.60	14	J	0.60	14	J	0.60	19	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	1.6	J	0.50	0.71		0.50	4.5	J	0.50	0.98		0.50	3.8		0.50	0.75		0.50	0.68	J	0.50	0.70		0.50		UJ	0.50	1.2	J	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		UJ	0.20		UJ	0.20

Sample Location	CSB-28C			CSB-28CD			CSB-29A			CSB-29B			CSB-29C			CSB-30A			CSB-30B			CSB-30C			CSB-30CD			CSB-31A		
Lab ID	230299			230300			230302			230303			230304			230305			230306			230307			230308			230314		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99		
Comments				FD of CSB-28C																					FD of CSB-30C					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.7		1.0		U	1.0	1.6		1.0	2.3		1.0	1.5		1.0	1.1	J	1.0		UJ	1.0	1.0	J	1.0	741	J	1.0	11		1.0
Arsenic	23	J	1.0	8.7	J	1.0	9.2	J	1.0	25	J	1.0	11	J	1.0	9.5		1.0	6.7		1.0	11		1.0	8.6		1.0	14		1.0
Barium	534	J	1.0	190	J	1.0	59	J	1.0	192	J	1.0	100	J	1.0	96	J	1.0	58	J	1.0	97	J	1.0	62	J	1.0	75	J	1.0
Cadmium	0.83		0.50		U	0.50		U	0.50	0.72		0.50	0.73		0.50	0.56		0.50		U	0.50		U	0.50		U	0.50		U	0.50
Chromium	61	J	1.0	18	J	1.0	17	J	1.0	44	J	1.0	21	J	1.0	16		1.0	10		1.0	21		1.0	14		1.0	18		1.0
Lead	29	J	0.60	10	J	0.60	32	J	0.60	44	J	0.60	36	J	0.60	16	J	0.60	13	J	0.60	15	J	0.60	24	J	0.60	431	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	3.4	J	0.50	1.4	J	0.50	0.92	J	0.50	3.3	J	0.50	1.3	J	0.50	1.5		0.50	0.53		0.50	1.0		0.50	1.1		0.50	0.92		0.50
Silver		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20		UJ	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Sample Date(s)	8/10-8/26, 9/1/99	Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-31B			CSB-31C			CSB-32A			CSB-32B			CSB-32C			CSB-33A			CSB-33B			CSB-33C			CSB-34A			CSB-34B		
Lab ID	230315			230316			230310			230311			230312			229965			229966			229967			229956			229957		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99		
Comments																														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	15		1.0		U	1.0		U	1.0	4.6		1.0	2.1		1.0	6.8		1.0	4.5		1.0	2.7		1.0	821		1.0	36		1.0
Arsenic	22		1.0	6.7	J	1.0	388		1.0	7.4		1.0	7.0		1.0	13		1.0	12		1.0	13		1.0	189		1.0	9.1		1.0
Barium	103	J	1.0	54		1.0	120	J	1.0	44	J	1.0	41	J	1.0	80		1.0	139		1.0	124		1.0	338		1.0	49		1.0
Cadmium	1.5		0.50		U	0.50	86		0.50	0.60		0.50		U	0.50	2.2		0.50	2.3		0.50	4.4		0.50	84		0.50	2.0		0.50
Chromium	14		1.0	9.5	U	1.0	14		1.0	8.8		1.0	9.1		1.0	25		1.0	17		1.0	21		1.0		U	1.0	9.6		1.0
Lead	2280	J	0.60	10		0.60	42800	J	0.60	403	J	0.60	694	J	0.60	196		0.60	868		0.60	245		0.60	94500		0.60	2360		0.60
Mercury		U	0.10		U	0.10	0.28		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	0.25		0.10		U	0.10
Selenium	0.96		0.50	0.75	J	0.50	15		0.50	0.89		0.50	0.60		0.50	1.6		0.50	0.84		0.50	0.74		0.50	3.6	J	0.50	0.66		0.50
Silver		UJ	0.20		U	0.20	0.86	J	0.20		UJ	0.20		UJ	0.20		U	0.20		U	0.20		U	0.20	2.2		0.20		U	0.20

Sample Location	CSB-34C			CSB-34CD			CSB-35A			CSB-35B			CSB-35C			CSB-35CD			CSB-35D			CSB-36A			CSB-36B			CSB-36C		
Lab ID	229958			229959			229969			229970			229972			229971			235318			229961			229962			229963		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99		
Comments				FD of CSB-34C												FD of CSB-35C														
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.6		1.0	1.6		1.0	42		1.0	8.7		1.0	16		1.0	15		1.0	67		1.0	2.2		1.0	2.0		1.0	1.6		1.0
Arsenic	7.0		1.0	6.5		1.0	8.4		1.0	9.5		1.0	7.0		1.0	7.9		1.0	12		1.0	170		1.0	15		1.0	12		1.0
Barium	40		1.0	44		1.0	65		1.0	47		1.0	41		1.0	45		1.0	62		1.0	94		1.0	128		1.0	141		1.0
Cadmium		U	0.50		U	0.50	3.6		0.50	0.79		0.50	1.2		0.50	1.4		0.50	3.6		0.50	3.1		0.50		U	0.50		U	0.50
Chromium	9.0		1.0	9.6		1.0	12		1.0	9.5		1.0	7.2		1.0	7.7		1.0	10		1.0	20		1.0	21		1.0	21		1.0
Lead	68		0.60	86		0.60	3090		0.60	518	J	0.60	1400	J	0.60	1120	J	0.60	10800		0.60	103		0.60	76		0.60	67		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium		U	0.50	0.60		0.50	1.2		0.50	0.73		0.50	0.77		0.50	0.68		0.50	1.1		0.50	7.5		0.50	1.2		0.50	1.2		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Sample Date(s)	8/10-8/26, 9/1/99	Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-37A			CSB-37B			CSB-37C			CSB-38A			CSB-38B			CSB-38C			CSB-38CD			CSB-39A			CSB-39B			CSB-39C		
Lab ID	229974			229975			229976			229944			229945			229946			229947			229982			229983			229984		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99		
Comments																			FD of CSB-38C											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	3.8		1.0	23		1.0	2.6		1.0		U	1.0		U	1.0		U	1.0		U	1.0	8550		1.0	7.3		1.0	1.4		1.0
Arsenic	30		1.0	7.9		1.0	6.8		1.0	4.9	J	1.0	4.4		1.0	7.8		1.0	8.4		1.0	863	J	1.0	8.0	J	1.0	5.8	J	1.0
Barium	65		1.0	43		1.0	47		1.0	75	J	1.0	149		1.0	169		1.0	164		1.0	132		1.0	54		1.0	44		1.0
Cadmium	126		0.50	3.9		0.50	1.9		0.50		U	0.50		U	0.50		U	0.50		U	0.50	39		0.50		U	0.50		U	0.50
Chromium	12		1.0	8.2		1.0	7.1		1.0	178		1.0	117		1.0	75		1.0	64		1.0	1.5		1.0	10		1.0	9.9		1.0
Lead	325	J	0.60	314	J	0.60	242	J	0.60	22	J	0.60	15	U	0.60	19	U	0.60	17	U	0.60	46800	J	0.60	69	J	0.60	15	U	0.6
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10	0.14		0.10		U	0.10		U	0.10
Selenium	1.6		0.50		U	0.50		U	0.50	0.76	J	0.50	1.4		0.50	0.53		0.50	0.70		0.50	21		0.50	0.84		0.50		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20	0.46		0.20		U	0.20		U	0.20

Sample Location	CSB-39CD			CSB-40A			CSB-40B			CSB-40C			CSB-41A			CSB-41B			CSB41-C			CSB-42A			CSB-42B			CSB-42C		
Lab ID	229985			229987			229988			229989			229990			229991			229992			229978			229979			229980		
Matrix	Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99			8/20/99		
Comments	FD of CSB-39C																													
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	1.4		1.0	313		1.0	1.3		1.0	1.2		1.0	2.0		1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Arsenic	9.0	J	1.0	39	J	1.0	6.4	J	1.0	11	J	1.0	4.8	J	1.0	7.6	J	1.0	6.3	J	1.0	23		1.0	73		1.0	7.8		1.0
Barium	43		1.0	62		1.0	132		1.0	96		1.0	51		1.0	105		1.0	57		1.0	25		1.0	42		1.0	51		1.0
Cadmium		U	0.50	24		0.50	11		0.50		U	0.50	0.87		0.50		U	0.50		U	0.50	7.0		0.50	1.7		0.50	0.41		0.50
Chromium	8.4		1.0	4.9		1.0	11		1.0	15		1.0	27		1.0	12		1.0	9.2		1.0	4.2		1.0	7.6		1.0	7.7		1.0
Lead	15	U	0.6	6660	J	0.60	20	U	0.6	14	U	0.6	45	J	0.60	8.9	U	0.6	8.8	U	0.6	11	U	0.6	11	U	0.6	15	U	0.6
Mercury		U	0.10	0.11		0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.54		0.50		U	0.50		U	0.50	0.67		0.50	0.91		0.50		U	0.50	0.57		0.50		U	0.50	0.93		0.50		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-43A			CSB-43B			CSB-43C			CSB-44A			CSB-44B		
Lab ID	230577			230578			230579			230572			230573		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/25/99			8/25/99			8/25/99			8/25/99			8/25/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	1.0	7.4		1.0		U	1.0		U	1.0	1.5		1.0
Arsenic	10		1.0	9.3		1.0	6.6		1.0	7.8		1.0	7.2		1.0
Barium	77		1.0	45		1.0	48		1.0	56		1.0	50		1.0
Cadmium		U	0.50	1.1		0.50		U	0.50		U	0.50	0.69		0.50
Chromium	17		1.0	11		1.0	13		1.0	14		1.0	13		1.0
Lead	14	J	0.60	106	J	0.60	24	J	0.60	32	J	0.60	12	J	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.77	J	0.50	0.81		0.50	0.79		0.50	1.6		0.50	0.76		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-44C			CSB-44CD			CSB-45A			CSB-45B			CSB-45C		
Lab ID	230574			230575			230563			230564			230565		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/25/99			8/25/99			8/25/99			8/25/99			8/25/99		
Comments				FD of CSB-44C											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	1.0		U	1.0	1.5		1.0	1.1		1.0		U	1.0
Arsenic	7.6		1.0	6.2		1.0	7.9		1.0	10		1.0	7.2		1.0
Barium	50		1.0	45		1.0	74		1.0	71		1.0	49		1.0
Cadmium		U	0.50		U	0.50		U	0.50	0.62		0.50		U	0.50
Chromium	13		1.0	8.7		1.0	15		1.0	15		1.0	11		1.0
Lead	20	J	0.60	11	J	0.60	27		0.60	12		0.60	9.9	U	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	0.85		0.50	1.4		0.50	1.8		0.50	1.6		0.50	1.8		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-46A			CSB-46B			CSB-46C			CSB-47A			CSB-47B		
Lab ID	230580			230581			230582			230566			230567		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/25/99			8/25/99			8/25/99			8/25/99			8/25/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	1.0		U	1.0		U	1.0	4.1		1.0		U	1.0
Arsenic	8.9		1.0	6.9		1.0	9.1		1.0	25		1.0	6.8		1.0
Barium	65		1.0	41		1.0	47		1.0	53		1.0	47		1.0
Cadmium	0.53		0.50		U	0.50	0.81		0.50		U	0.50		U	0.50
Chromium	10		1.0	8.1		1.0	11		1.0	13		1.0	10		1.0
Lead	12	J	0.60	12	J	0.60	9.7	J	0.60	58		0.60	11	U	0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	1.3		0.50	0.74		0.50	0.66		0.50	2.1	J	0.50	1.6		0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

Sample Location	CSB-47C			CSB-47CD			CSB-49A			CSB-49B			CSB-49C		
Lab ID	230568			230569			229953			229954			229955		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/25/99			8/25/99			8/20/99			8/20/99			8/20/99		
Comments				FD of CSB-47C											
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	1.0		U	1.0	4.0		1.0		U	1.0	1.5		1.0
Arsenic	5.9		1.0	6.4		1.0	8.1		1.0	6.4		1.0	6.8		1.0
Barium	41		1.0	43		1.0	56		1.0	56		1.0	43		1.0
Cadmium		U	0.50		U	0.50	0.56		0.50		U	0.50		U	0.50
Chromium	7.7		1.0	8.3		1.0	8.4		1.0	10		1.0	8.6		1.0
Lead	10	U	0.60	14		0.60	147		0.60	18	U	0.6	17	U	0.6
Mercury		U	0.10		U	0.10		U	0.10		U	0.10		U	0.10
Selenium	1.6		0.50	0.59		0.50	1.1	J	0.50		U	0.50		U	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20		U	0.20

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Q - Qualifier.
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QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	CSB-50A			CSB-50B			CSB-50C			CSB-50CD			CSB-51A		
Lab ID	230254			230255			230256			230257			229949		
Matrix	Soil			Soil			Soil			Soil			Soil		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/20/99		
Comments										FD of CSB-50C					
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	17		1.0	1.9		1.0	3.8		1.0	2.0		1.0	873		1.0
Arsenic	15		1.0	13		1.0	10		1.0	11		1.0	265		1.0
Barium	180	J	1.0	100	J	1.0	168	J	1.0	133	J	1.0	228		1.0
Cadmium	1.0		0.50		U	0.50	0.56		0.50		U	0.50	28		0.50
Chromium	15	J	1.0	19	J	1.0	32	J	1.0	21	J	1.0	2.8		1.0
Lead	480	J	0.60	131	J	0.60	229	J	0.60	111	J	0.60	47300		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	0.14		0.10
Selenium	3.8		0.50	1.3		0.50	2.0	J	0.50	1.1		0.50	3.0	J	0.50
Silver		U	0.20		U	0.20		U	0.20		U	0.20	0.99		0.20

Sample Location	CSB-51B			CSB-51C			CSB-51D			CSB-51E			CSED-1A		
Lab ID	229950			229951			235319			235320			230585		
Matrix	Soil			Soil			Soil			Soil			Sediment		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/25/99		
Comments															
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	86		1.0	79		1.0	282		1.0	47		1.0	837		1.0
Arsenic	187		1.0	17		1.0	36		1.0	26		1.0	653		1.0
Barium	81		1.0	69		1.0	123		1.0	69		1.0	45		1.0
Cadmium	6.0		0.50	4.4		0.50	8.1		0.50	3.4		0.50	250		0.50
Chromium	12		1.0	10		1.0	11		1.0	8.5		1.0	18		1.0
Lead	10300		0.60	5680		0.60	18700		0.60	12000		0.60	43900		0.60
Mercury		U	0.10		U	0.10		U	0.10		U	0.10	1.9		0.10
Selenium	3.9		0.50	1.7		0.50	2.6		0.50	0.98		0.50	44		0.50
Silver	0.21		0.20	0.90		0.20	0.24		0.20		U	0.20	0.84		0.20

Sample Location	CSED-2A			CSED-3A			CSED-4A			CSED-4B			EQ-4		
Lab ID	230589			230586			230587			230588			229242		
Matrix	Sediment			Sediment			Sediment			Sediment			Aqueous		
Units	mg/kg			mg/kg			mg/kg			mg/kg			ug/L		
Sample Date	8/25/99			8/25/99			8/25/99			8/25/99			8/12/99		
Comments													Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony	2170		1.0	1910		1.0	199		1.0	204		1.0	NA		
Arsenic	229		1.0	368		1.0	189		1.0	182		1.0	NA		
Barium	118		1.0	100		1.0	62		1.0	58		1.0	NA		
Cadmium	351		0.50	268		0.50	22		0.50	30		0.50		U	0.2
Chromium	29		1.0	32		1.0	17		1.0	19		1.0	NA		
Lead	138000		0.60	161000		0.60	7390		0.60	11000		0.60	28		1
Mercury	2.5		0.10	6.6		0.10	0.24	J	0.10	0.61		0.10	NA		
Selenium	34		0.50	40		0.50	3.6		0.50	3.5		0.50	NA		
Silver	2.3		0.20	1.7		0.20		U	0.20	0.24		0.20	NA		

Sample Location	EQ-8			EQ-9			EQ-10			EQ-11			EQ-13		
Lab ID	229453			229457			229462			229470			229478		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/17/99			8/17/99			8/17/99			8/17/99			8/17/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium	6.9		1.0	1.0		1.0		U	1.0		U	1.0		U	1.0
Lead	7.5		1.0		U	1.0		U	1.0	2.3		1.0		U	1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99

Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	EQ-14			EQ-15			EQ-16			EQ-18			EQ-19		
Lab ID	229486			229490			229495			229767			229771		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/17/99			8/17/99			8/17/99			8/19/99			8/19/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead	1.2		1.0	1.1		1.0	4.9		1.0	260		1.0	41		1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.20		U	0.20		U	0.20		U	0.2		U	0.2

Sample Location	EQ-20			EQ-21			EQ-22			EQ-24			EQ-25		
Lab ID	229775			229779			229784			229943			229948		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/19/99			8/19/99			8/19/99			8/20/99			8/20/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead	9.0		1.0	10		1.0	1.6		1.0	1.4		1.0	25		1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

Sample Location	EQ-26			EQ-27			EQ-28			EQ-30			EQ-31		
Lab ID	229952			229960			229964			229968			229973		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/20/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead	40		1.0	63		1.0	30		1.0	118		1.0	106		1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

Sample Location	EQ-32			EQ-33			EQ-34			EQ-35			EQ-43		
Lab ID	229977			229981			229986			229993			230249		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/20/99			8/20/99			8/20/99			8/20/99			8/23/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead	92		1.0	37		1.0	24		1.0	91		1.0	14		1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

F:\Oficeago\Common\QA\Refined\Beechgrove\August1999.xls

QA Scientist *Megan Cloud* Date *12/22/99*

BEECH GROVE CLOSURE INVESTIGATION
INORGANIC DATA SUMMARY TABLE
AUGUST 1999
SOIL AND SEDIMENT SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	8/10-8/26, 9/1/99
Laboratory	TriMatrix Laboratories
Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 27
Method	SW-846 6010B, 7470 & 7471

Sample Location	EQ-44			EQ-45			EQ-48			EQ-49			EQ-50			EQ-51			EQ-52			EQ-53			EQ-54			EQ-55		
Lab ID	230253			230258			230262			230292			230296			230301			230309			230313			230318			230326		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/23/99			8/24/99			8/24/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2	0.4		0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead	141		1.0	250		1.0		U	1.0	3.7		1.0	1.6		1.0	3.6		1.0	4.9		1.0	2.1		1.0	1.4		1.0		U	1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

Sample Location	EQ-60			EQ-61			EQ-62			EQ-63			EQ-64			EQ-65			EQ-69		
Lab ID	230571			230576			230562			230570			230583			230584			230769		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	ug/L			ug/L			ug/L			ug/L			ug/L			ug/L			ug/L		
Sample Date	8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/25/99			8/26/99		
Comments	Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Barium		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0
Lead		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0		U	1.0	6.9		1.0
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0		U	2.0
Silver		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2

DL - Detection Limit prior to any dilutions.
Q - Qualifier.
U - The analyte was not detected at or above the associated value or reflects an adjusted detection limit due to blank contamination.
J - Denotes an estimated result.
FD - Field duplicate.

QA Scientist Megan Cloud Date 12/22/99

BEECH GROVE, IN
PH DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 23, 27
Sample Date(s)	8/9-8/20/99	Method	EPA Method 9045C

LAB ID	LOCATION	RESULT	Q	LAB ID	LOCATION	RESULT	Q
229463	CSB-1A	7.92	J	229497	CSB-11B	7.55	J
229464	CSB-1B	7.64	J	229498	CSB-11C	7.39	J
229465	CSB-1C	7.13	J	229499	CSB-12A	7.25	J
229479	CSB-2A	7.34	J	229500	CSB-12B	7.29	J
229480	CSB-2B	7.36	J	229501	CSB-12C	6.70	J
229481	CSB-2C	7.79	J	229487	CSB-13A	7.50	J
229454	CSB-3A	7.90	J	229488	CSB-13B	7.22	J
229455	CSB-3B	8.96	J	229489	CSB-13C	7.19	J
229456	CSB-3C	11.27	J	229768	CSB-14A	8.35	J
235313	CSB-3D	9.99	J	229769	CSB-14B	8.75	J
235314	CSB-3E	7.29	J	229770	CSB-14C	8.82	J
229458	CSB-4A	8.09	J	229763	CSB-15A	8.30	J
229459	CSB-4B	7.65	J	229764	CSB-15B	10.33	J
229460	CSB-4BD	7.93	J	229765	CSB-15C	9.19	J
229461	CSB-4C	8.02	J	229766	CSB-15CD	7.52	J
229471	CSB-5A	8.00	J	229776	CSB-16A	6.95	J
229472	CSB-5B	7.89	J	229777	CSB-16B	7.92	J
229473	CSB-5C	6.86	J	229778	CSB-16C	10.21	J
229475	CSB-6A	7.86	J	229780	CSB-17A	8.46	J
229476	CSB-6B	7.43	J	229781	CSB-17B	8.12	J
229477	CSB-6C	5.72	J	229782	CSB-17C	9.27	J
229466	CSB-7A	7.81	J	229783	CSB-17CD	9.04	J
229467	CSB-7B	7.69	J	230267	CSB-18A	9.64	J
229468	CSB-7C	8.21	J	230268	CSB-18B	8.90	J
229469	CSB-7CD	8.41	J	230269	CSB-18C	8.45	J
235315	CSB-7D	8.08	J	230263	CSB-19A	10.07	J
235316	CSB-7E	8.18	J	230264	CSB-19B	9.26	J
229772	CSB-8A	8.26	J	230265	CSB-19C	9.00	J
229773	CSB-8B	8.43	J	230266	CSB-19CD	9.19	J
229774	CSB-8C	8.98	J	229785	CSB-20A	8.55	J
229482	CSB-9A	4.62	J	229786	CSB-20B	8.70	J
229483	CSB-9B	4.23	J	229787	CSB-20C	8.56	J
229484	CSB-9C	7.34	J	230293	CSB-21A	8.71	J
229485	CSB-9CD	7.44	J	230294	CSB-21B	8.63	J
229491	CSB-10A	6.79	J	230295	CSB-21C	8.53	J
229492	CSB-10B	6.64	J	230327	CSB-22A	8.42	J
229493	CSB-10C	7.32	J	230328	CSB-22B	8.45	J
229494	CSB-10CD	7.37	J	230329	CSB-22C	8.45	J
235317	CSB-10D	5.87	J	230322	CSB-23A	7.55	J
229496	CSB-11A	7.62	J	230323	CSB-23B	7.94	J

All results are reported in Standard Units with a detection limit of 1.00.
Q - Qualifier.
J - Estimated result.

August1999.xls

QA Scientist M. Cloud Date 11/17/99

BEECH GROVE, IN
PH DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 23, 27
Sample Date(s)	8/9-8/20/99	Method	EPA Method 9045C

LAB ID	LOCATION	RESULT	Q
230324	CSB-23C	8.31	J
230325	CSB-23CD	8.28	J
230319	CSB-24A	7.04	J
230320	CSB-24B	7.03	J
230321	CSB-24C	7.40	J
230246	CSB-25A	9.06	J
230247	CSB-25B	8.26	J
230248	CSB-25C	9.10	J
230259	CSB-26A	9.72	J
230260	CSB-26B	9.61	J
230261	CSB-26C	9.96	J
230250	CSB-27A	8.05	J
230251	CSB-27B	8.34	J
230252	CSB-27C	8.53	J
230297	CSB-28A	7.43	J
230298	CSB-28B	6.05	J
230299	CSB-28C	6.85	J
230300	CSB-28CD	6.80	J
230302	CSB-29A	6.06	J
230303	CSB-29B	6.58	J
230304	CSB-29C	7.43	J
230305	CSB-30A	8.03	J
230306	CSB-30B	9.48	J
230307	CSB-30C	8.34	J
230308	CSB-30CD	9.06	J
230314	CSB-31A	6.02	J
230315	CSB-31B	7.39	J
230316	CSB-31C	8.06	J
230310	CSB-32A	8.08	J
230311	CSB-32B	8.15	J
230312	CSB-32C	8.11	J
229965	CSB-33A	6.73	J
229966	CSB-33B	7.15	J
229967	CSB-33C	7.73	J
229956	CSB-34A	9.19	J
229957	CSB-34B	8.12	J
229958	CSB-34C	8.55	J
229959	CSB-34CD	8.76	J
229969	CSB-35A	8.80	J
229970	CSB-35B	8.73	J

LAB ID	LOCATION	RESULT	Q
229972	CSB-35C	8.80	J
229971	CSB-35CD	8.68	J
235318	CSB-35D	8.44	J
229961	CSB-36A	7.31	J
229962	CSB-36B	5.03	J
229963	CSB-36C	5.40	J
229974	CSB-37A	9.63	J
229975	CSB-37B	9.19	J
229976	CSB-37C	9.28	J
229944	CSB-38A	8.06	J
229945	CSB-38B	6.07	J
229946	CSB-38C	7.09	J
229947	CSB-38CD	7.70	J
229982	CSB-39A	8.65	J
229983	CSB-39B	8.67	J
229984	CSB-39C	8.52	J
229985	CSB-39CD	8.63	J
229987	CSB-40A	9.96	J
229988	CSB-40B	8.77	J
229989	CSB-40C	8.88	J
229990	CSB-41A	9.21	J
229991	CSB-41B	8.24	J
229992	CSB-41C	8.69	J
229978	CSB-42A	9.13	J
229979	CSB-42B	8.63	J
229980	CSB-42C	8.66	J
230577	CSB-43A	9.03	J
230578	CSB-43B	8.78	J
230579	CSB-43C	9.14	J
230572	CSB-44A	9.46	J
230573	CSB-44B	8.86	J
230574	CSB-44C	8.60	J
230575	CSB-44CD	8.60	J
230563	CSB-45A	10.62	J
230564	CSB-45B	8.64	J
230565	CSB-45C	8.70	J
230580	CSB-46A	9.50	J
230581	CSB-46B	9.24	J
230582	CSB-46C	8.47	J
230566	CSB-47A	11.28	J

All results are reported in Standard Units with a detection limit of 1.00.
Q - Qualifier.
J - Estimated result.

QA Scientist U. Cloud Date 11/17/99

BEECH GROVE, IN
PH DATA SUMMARY TABLE
AUGUST 1999

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-4-6, 8, 9, 13, 15, 16, 20, 21, 23, 27
Sample Date(s)	8/9-8/20/99	Method	EPA Method 9045C

LAB ID	LOCATION	RESULT	Q
230567	CSB-47B	8.95	J
230568	CSB-47C	8.51	J
230569	CSB-47CD	8.69	J
229953	CSB-49A	8.73	J
229954	CSB-49B	8.72	J
229955	CSB-49C	8.26	J
230254	CSB-50A	7.93	J
230255	CSB-50B	5.54	J
230256	CSB-50C	5.35	J
230257	CSB-50CD	5.48	J
229949	CSB-51A	8.30	J
229950	CSB-51B	8.43	J
229951	CSB-51C	8.36	J
235319	CSB-51D	8.18	J
235320	CSB-51E	8.25	J
230585	CSED-1A	7.00	J
230589	CSED-2A	6.94	J
230586	CSED-3A	7.49	J
230587	CSED-4A	7.25	J
230588	CSED-4B	7.28	J
230762	BSB-1A	7.75	J
230763	BSB-1B	7.76	J
230764	BSB-1C	7.81	J
230760	BSB-2A	5.43	J
230761	BSB-2B	5.42	J
230765	BSB-3A	6.28	J
230766	BSB-3B	6.72	J
230767	BSB-4A	7.94	J
230768	BSB-4B	8.01	J

All results are reported in Standard Units with a detection limit of 1.00.

Q - Qualifier.

J - Estimated result.

QA Scientist M. Cloud Date 11/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -4	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47078	Method Preparation	1	41.5

no samples reported for lead w/this method blk

lead 22.4 mg/kg -

Associated samples: 229454, 55, 56, 58, 59, 60, 61, 63, 64, 65, 66, 67, 68, 69, 71, 73, 76, 77, 72

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TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -5	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47109	Method Preparation	1	20.2

Associated samples:
229482-85
229487-89
~~229491~~
229493+94

method blk

19.3 mg/kg

Associated samples: 229479-81,
229491-92, 229496-501
DJM 11/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -6	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47091	Method Preparation	1	3.9

Associated Samples: 229763, 64, 65, 66
229768-70, 72, 73, 74, 76, 77, 78, 80
81, 82, 83, 85, 86 + 87
DJM 11/17/99

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QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -6	Parameter	Antimony, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47125	Method Preparation	1	6.80

Associated samples:
229763-66
229768-70
229772-74
229776-78
229780-83
229785-87
Dm 11/3/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -9	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47155	Method Preparation	1	3.0

Associated data:
229945, ~~229949, 53, 54, 55, 56~~

Lead 5.97 Associated data
229946, 47, 49, 50, 51, 53, 54, 55, 56, 57, 58, 59
60, 61, 62, 63, 65, 66, 67, 69

DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -10	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47158	Method Preparation	1	7.44
47159	Method Preparation	1	0.70

7.44 - Associated samples -
230200, 202, 205, 206, 207, 209, 210, 204
211, 212, 213, 215, 216, 217, 218, 219
220, 221, 222,

0.70 - Associated samples:
229969, 230179, 230180, 181, 182, 184, 185, 186, 187, 188, 189,
190, 191, 193, 194, 195, 196, 197, 198, 199

Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -12	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47160	Method Preparation	1	<0.60
47168	Method Preparation	1	0.61

Associated samples:
230245, 230246, 47, 48, 51, 52, 50
54, 55, 56, 57, 59, 60, 61, 63, 64
65, 66, 67, 68

all over 5x MB
DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -13	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47168	Method Preparation	1	0.61
47623	Method Preparation	1	<0.60

Associated data:
230 245, 246, 247, 248,
~~250~~, 251, 252, 254, 255
256, 257, 259, 260, 263
264, 265

Dim

all > 5x MB

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -14	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47623	Method Preparation	1	<0.60
47812	Method Preparation	1	1.98

Associated data:
230291, 293, 295, 297, 298,
299, 300, 302, 303, 304, 305,
306, 307, 308

DJM

all > 5x MB

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -16	Parameter	Chromium, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47813	Method Preparation	1	6.83

Associated data:
230316, 319, 320, 321,
322, 323, 324, 325, 327
328 + 329, 30, 31, 32, 34-38
DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -16	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47813	Method Preparation	1	1.07

Associated data: 230316, 319, 320, 321, 322, 323, 324, 325, 327, 328

DIm

all > 5x MB

TriMatrix
Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -20	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
47624	Method Preparation	1	2.36
47626	Method Preparation	1	1.24

Pb 1.24 - Associated samples: 230572, 573, 574
575, 577, 579, 580, 581, +582
non above 5x Blk
Pb 2.36 - Associated samples: 230564, 565, 566,
567, 568, 569

DM

TriMatrix Laboratorics, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -27	Parameter	Lead, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
48972	Method Preparation	1	0.616

Associated samples:
235313-20
DIM

All over 5x MB

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -27	Parameter	Antimony, Total
Instrument ID	114	Ref. Cit.	USEPA-6020
		Matrix	SOIL
		Units	mg/kg dry

Batch	Blank QC Type	Sequence No.	Amount Found
48910	Method Preparation	1	4.2

Associated samples:
235313 - 235320
DIM

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TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -4	Matrix	SOIL
		Lab Sample No.	229465
Sample ID.	CSB1CMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	70 - 130	107.5	19		100	89	MS
Antimony, Total	70 - 130	103.7	19		100	85	MS
Arsenic, Total	73 - 121	125.2 ✓	8.0		125	94	MS
Arsenic, Total	73 - 121	111.9 ✓	8.0		125	83	MS
Barium, Total	69 - 131	175.6 ✓	56		125	96	MS
Barium, Total	69 - 131	194.4 ✓	56		125	111	MS
Cadmium, Total	83 - 114	26.4 ✓	3.3		25.0	92	MS
Cadmium, Total	83 - 114	27.2 ✓	3.3		25.0	96	MS
Chromium, Total	69 - 130	125.7 ✓	9.0		125	93	MS
Chromium, Total	69 - 130	134.2 ✓	9.0		125	100	MS
Lead, Total	74 - 132	604.6	511		125	75	MS
Lead, Total	74 - 132	772.7	511		125	209	MS
Mercury, Total	73 - 136	0.448	<0.10	U	0.417	107	CV
Mercury, Total	73 - 136	0.474	<0.10	U	0.417	114	CV
Selenium, Total	62 - 126	94.0 ✓	0.63		125	75	MS
Selenium, Total	62 - 126	112.7 ✓	0.63		125	90	MS
Silver, Total	78 - 115	17.4 ✓	<0.20	U	25.0	70	MS
Silver, Total	78 - 115	22.3 ✓	<0.20	U	25.0	89	MS

Associated Samples
Pb, Ag - 229454-56
229458-61
229463-69
229471-73
229475-77

DJM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No. 35132 -4

Sample ID. CSB1CMS/MSD

Matrix SOIL
Lab Sample No. 229465
Units mg/kg dry

Analyte	Control Limit	Sample Result	Duplicate Spike Result	RPD	M
Antimony, Total	0 - 20	107.5	103.7	4	MS
Arsenic, Total	0 - 20	125.2	111.9	11	MS
Barium, Total	0 - 20	175.6	194.4	10	MS
Cadmium, Total	0 - 20	27.2	26.4	3	MS
Chromium, Total	0 - 20	134.2	125.7	7	MS
Lead, Total	0 - 20	604.6	772.7	24	MS
Mercury, Total	0 - 20	0.448	0.474	6	CV
Selenium, Total	0 - 20	112.7	94.0	18	MS
Silver, Total	0 - 20	22.3	17.4	25	MS

Associated data:
229454, 55, 56, 58, 59, 60, 61
63, 64, 65, 66, 67, 68, 69, 71
72, 73, 75, 76, 77

Dm

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -6	Matrix	SOIL
		Lab Sample No.	229770
Sample ID.	CSB14CMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	70 - 130	93.0	1.0		100	92	MS
Antimony, Total	70 - 130	96.4	1.0		100	95	MS
Arsenic, Total	73 - 121	124.4	6.4		125	94	MS
Arsenic, Total	73 - 121	118.4	6.4		125	90	MS
Barium, Total	69 - 131	182.1	69		125	90	MS
Barium, Total	69 - 131	182.9	69		125	91	MS
Cadmium, Total	83 - 114	23.7	<0.50	U	25.0	95	MS
Cadmium, Total	83 - 114	23.3	<0.50	U	25.0	93	MS
Chromium, Total	69 - 130	114.7	11		125	83	MS
Chromium, Total	69 - 130	117.4	11		125	85	MS
Lead, Total	74 - 132	128.5	18		125	88	MS
Lead, Total	74 - 132	124.7	18		125	85	MS
Mercury, Total	73 - 136	0.453	<0.10	U	0.417	109	CV
Mercury, Total	73 - 136	0.541	<0.10	U	0.417	130	CV
Selenium, Total	62 - 126	105.8	<0.50	U	125	85	MS
Selenium, Total	62 - 126	114.8	<0.50	U	125	92	MS
Silver, Total	78 - 115	21.2	<0.20	U	25.0	85	MS
Silver, Total	78 - 115	21.5	<0.20	U	25.0	86	MS

Associated data:
Estimate detects only
229772
DIM

[illegible] • Grand Rapids, MI 49512 • [illegible] 975-[illegible]500 • Fax (616) 942-7[illegible]

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -7	Matrix	SOIL
		Lab Sample No.	229935
Sample ID.	RSB74BMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Arsenic, Total	73 - 121	124.9	9.0		125	93	MS
Arsenic, Total	73 - 121	100.4	9.0		125	73	MS
Barium, Total	69 - 131	237.8	133		125	84	MS
Barium, Total	69 - 131	222.0	133		125	71	MS
Cadmium, Total	83 - 114	25.9	<0.50	U	25.0	104	MS
Cadmium, Total	83 - 114	25.4	<0.50	U	25.0	102	MS
Chromium, Total	69 - 130	142.4	19		125	99	MS
Chromium, Total	69 - 130	131.1	19		125	90	MS
Lead, Total	74 - 132	262.6	177		125	68	MS
Lead, Total	74 - 132	333.7	177		125	125	MS
Mercury, Total	73 - 136	0.478	<0.10	U	0.417	115	CV
Mercury, Total	73 - 136	0.458	<0.10	U	0.417	110	CV
Selenium, Total	62 - 126	75.0	0.77		125	59	MS
Selenium, Total	62 - 126	116.6	0.77		125	93	MS
Silver, Total	78 - 115	23.0	<0.20	U	25.0	92	MS
Silver, Total	78 - 115	22.9	<0.20	U	25.0	92	MS

Associated Samples:
229921, 22, 23, 24, 25, 26, 27, 28, 30
31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 44

DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No. 35132 -7

Sample ID. RSB74BMS/MSD

Matrix SOIL
Lab Sample No. 229935
Units mg/kg dry

Analyte	Control Limit	Sample Result	Duplicate Spike Result	RPD	M
Arsenic, Total	0 - 20	124.9	100.4	22	MS
Barium, Total	0 - 20	237.8	222.0	7	MS
Cadmium, Total	0 - 20	25.9	25.4	2	MS
Chromium, Total	0 - 20	142.4	131.1	8	MS
Lead, Total	0 - 20	262.6	333.7	24	MS
Mercury, Total	0 - 20	0.478	0.458	4	CV
Selenium, Total	0 - 20	116.6	75.0	43	MS
Silver, Total	0 - 20	22.9	23.0	0	MS

Associated Samples:
229921-28, 229930-36
229938-41, 229944
DM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -9	Matrix	SOIL
		Lab Sample No.	229976
Sample ID.	CSB37CMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	70 - 130	96.4	2.6		100	94	MS
Antimony, Total	70 - 130	101.5	2.6		100	99	MS
Arsenic, Total	73 - 121	124.5	6.8		125	94	MS
Arsenic, Total	73 - 121	129.1	6.8		125	98	MS
Barium, Total	69 - 131	164.2	47		125	94	MS
Barium, Total	69 - 131	165.9	47		125	95	MS
Cadmium, Total	83 - 114	27.0	1.9		25.0	100	MS
Cadmium, Total	83 - 114	25.9	1.9		25.0	96	MS
Chromium, Total	69 - 130	119.4	7.1		125	90	MS
Chromium, Total	69 - 130	120.0	7.1		125	90	MS
Lead, Total	74 - 132	379.2	242		125	110	MS
Lead, Total	74 - 132	300	242		125	46	MS
Mercury, Total	73 - 136	0.425	<0.10	U	0.417	102	CV
Mercury, Total	73 - 136	0.428	<0.10	U	0.417	103	CV
Selenium, Total	62 - 126	101.0	<0.50	U	125	81	MS
Selenium, Total	62 - 126	100.9	<0.50	U	125	81	MS
Silver, Total	78 - 115	23.6	<0.20	U	25.0	94	MS
Silver, Total	78 - 115	22.7	<0.20	U	25.0	91	MS

Associated samples:
229970, 71, 72, 74, 75, 76
78, 79, 80, 82, 83, 84, 85,
87, 88, 89, 90, 91, 92
RM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No.	35132 -9	Matrix	SOIL
		Lab Sample No.	229976
Sample ID.	CSB37CMS/MSD	Units	mg/kg dry

Analyte	Control Limit	Sample Result	Duplicate Spike Result	RPD	M
Antimony, Total	0 - 20	96.4	101.5	5	MS
Arsenic, Total	0 - 20	124.5	129.1	4	MS
Barium, Total	0 - 20	164.2	165.9	1	MS
Cadmium, Total	0 - 20	25.9	27.0	4	MS
Chromium, Total	0 - 20	119.4	120.0	1	MS
Lead, Total	0 - 20	379.2	300	23	MS
Mercury, Total	0 - 20	0.425	0.428	1	CV
Selenium, Total	0 - 20	100.9	101.0	0	MS
Silver, Total	0 - 20	22.7	23.6	4	MS

Associated samples:
229970-72, 229974-76
229978-80, 229982-85,
229987 - 92
mm

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -14	Matrix	SOIL
		Lab Sample No.	230277
Sample ID.	RSB79BMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Arsenic, Total	73 - 121	123.5	6.9		125	93	MS
Arsenic, Total	73 - 121	128.9	6.9		125	98	MS
Barium, Total	69 - 131	170.7	62		125	87	MS
Barium, Total	69 - 131	179.9	62		125	94	MS
Cadmium, Total	83 - 114	28.5	6.4		25	88	MS
Cadmium, Total	83 - 114	29.5	6.4		25	92	MS
Chromium, Total	69 - 130	123.2	11		125	90	MS
Chromium, Total	69 - 130	130.6	11		125	96	MS
Lead, Total	74 - 132	253.9	205		125	39	MS
Lead, Total	74 - 132	299.5	205		125	76	MS
Mercury, Total	73 - 136	0.481	<0.10	U	0.417	115	CV
Mercury, Total	73 - 136	0.473	<0.10	U	0.417	113	CV
Selenium, Total	62 - 126	114.9	0.54		125	91	MS
Selenium, Total	62 - 126	110.0	0.54		125	88	MS
Silver, Total	78 - 115	21.6	<0.20	U	25	86	MS
Silver, Total	78 - 115	21.9	<0.20	U	25	88	MS

Associated samples:
230269-74, 230276-81
230283-90

Dm

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -15	Matrix	SOIL
		Lab Sample No.	230304
Sample ID.	CSBCSB29CMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	68 - 126	97.3	1.5		100	96	MS
Antimony, Total	68 - 126	101.4	1.5		100	100	MS
Arsenic, Total	73 - 121	109.8	11		125	79	MS
Arsenic, Total	73 - 121	108.2	11		125	78	MS
Barium, Total	69 - 131	185.4	100		125	68	MS
Barium, Total	69 - 131	183.9	100		125	67	MS
Cadmium, Total	83 - 114	21.3	0.73		25	82	MS
Cadmium, Total	83 - 114	20.6	0.73		25	79	MS
Chromium, Total	69 - 130	114.9	21		125	75	MS
Chromium, Total	69 - 130	118.8	21		125	78	MS
Lead, Total	74 - 132	125.6	36		125	72	MS
Lead, Total	74 - 132	125.0	36		125	71	MS
Mercury, Total	73 - 136	0.493	<0.10	U	0.417	118	CV
Mercury, Total	73 - 136	0.495	<0.10	U	0.417	119	CV
Selenium, Total	62 - 126	117.3	1.3		125	93	MS
Selenium, Total	62 - 126	106.8	1.3		125	84	MS
Silver, Total	78 - 115	19.0	<0.20	U	25	76	MS
Silver, Total	78 - 115	18.6	<0.20	U	25	74	MS

Used 75-125% R as criteria
stated in QAPP.
Associated data:
230291, 230293-95,
230297-300, 230302-308
230310-312, 230314-15

DLM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -16		Matrix	SOIL
			Lab Sample No.	230321
Sample ID.	CSB24CMS/MSD		Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	68 - 126	92.1	<1.0	U	100	92	MS
Antimony, Total	68 - 126	93.2	<1.0	U	100	93	MS
Arsenic, Total	73 - 121	98.1	4.4		125	75	MS
Arsenic, Total	73 - 121	123.3	4.4		125	95	MS
Barium, Total	69 - 131	216.2	116		125	80	MS
Barium, Total	69 - 131	233.6	116		125	94	MS
Cadmium, Total	83 - 114	23.4	<0.50	U	25	94	MS
Cadmium, Total	83 - 114	23.5	<0.50	U	25	94	MS
Chromium, Total	69 - 130	124.7	17		125	86	MS
Chromium, Total	69 - 130	134.7	17		125	94	MS
Lead, Total	74 - 132	123.9	12		125	90	MS
Lead, Total	74 - 132	124.0	12		125	90	MS
Mercury, Total	73 - 136	0.513	<0.10	U	0.417	123	CV
Mercury, Total	73 - 136	0.516	<0.10	U	0.417	124	CV
Selenium, Total	62 - 126	91.9	0.92		125	73	MS
Selenium, Total	62 - 126	117.0	0.92		125	93	MS
Silver, Total	78 - 115	22.5	<0.20	U	25	90	MS
Silver, Total	78 - 115	22.5	<0.20	U	25	90	MS

Associated samples:
230316, 230319, 320, 321, 23
322, 324, 325, 327, 328
329, 330, 331, 332, 334
335, 336, 337 ~~+ 338~~
Dim

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No.	35132 -16	Matrix	SOIL
		Lab Sample No.	230321
Sample ID.	CSB24CMS/MSD	Units	mg/kg dry

Analyte	Control Limit	(MS) Sample Result	(MSD) Duplicate Spike Result	RPD	M
Antimony, Total	0 - 20	92.1	93.2	1	MS
Arsenic, Total	0 - 20	98.1	123.3	23	MS
Barium, Total	0 - 20	216.2	233.6	8	MS
Cadmium, Total	0 - 20	23.4	23.5	0	MS
Chromium, Total	0 - 20	124.7	134.7	8	MS
Lead, Total	0 - 20	123.9	124.0	0	MS
Mercury, Total	0 - 20	0.513	0.516	1	CV
Selenium, Total	0 - 20	91.9	117.0	24	MS
Silver, Total	0 - 20	22.5	22.5	0	MS

Associated samples:
230316, 230319, 320, 321
322, 324, 325, 327, 328,
329, 330, 331, 332, 334,
335, 336, 337 + 338
DM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No.	35132 -17	Matrix	SOIL
		Lab Sample No.	230338
Sample ID.	RSB26BMS/MSD	Units	mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result	Spike Added	%R	M
Arsenic, Total	73 - 121	290.7	184	125	85	MS
Arsenic, Total	73 - 121	485.8	184	125	241	MS
Barium, Total	69 - 131	228.5	114	125	92	MS
Barium, Total	69 - 131	219.1	114	125	84	MS
Cadmium, Total	83 - 114	33.1	10	25	92	MS
Cadmium, Total	83 - 114	37.8	10	25	111	MS
Chromium, Total	69 - 130	128.5	21	125	86	MS
Chromium, Total	69 - 130	124.5	21	125	83	MS
Mercury, Total	73 - 136	0.892	0.36	0.417	128	CV
Mercury, Total	73 - 136	0.874	0.36	0.417	123	CV
Selenium, Total	62 - 126	102.6	4.6	125	78	MS
Selenium, Total	62 - 126	116.7	4.6	125	90	MS
Silver, Total	78 - 115	22.2	0.23	25	88	MS
Silver, Total	78 - 115	22.0	0.23	25	87	MS

Hg - Estimated detected results
230334, 337, 338, 340
339
DIM

As - Estimated detected results
Associated samples:
230316, 230319-25,
230327-32, 230334-38
DIM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No.	35132 -17		Matrix	SOIL
			Lab Sample No.	230338
Sample ID.	RSB26BMS/MSD		Units	mg/kg dry

Analyte	Control Limit	(MS) Sample Result	(MSD) Duplicate Spike Result	RPD	M
Arsenic, Total	0 - 20	290.7	485.8	50	MS
Barium, Total	0 - 20	228.5	219.1	4	MS
Cadmium, Total	0 - 20	33.1	37.8	13	MS
Chromium, Total	0 - 20	128.5	124.5	3	MS
Mercury, Total	0 - 20	0.892	0.874	2	CV
Selenium, Total	0 - 20	102.6	116.7	13	MS
Silver, Total	0 - 20	22.0	22.2	1	MS

Associated data:
230316, 230319-25,
230327-32, 230334-38
DJM

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -23

Sample ID. RSB3AMS/MSD

Matrix SOIL
Lab Sample No. 230765
Units mg/kg dry

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	68 - 126	95.7	4.0		100	92	MS
Antimony, Total	68 - 126	97.6	4.0		100	94	MS
Arsenic, Total	73 - 121	117.9	7.0		125	89	MS
Arsenic, Total	73 - 121	116.3	7.0		125	87	MS
Barium, Total	69 - 131	217.4	98		125	96	MS
Barium, Total	69 - 131	211.4	98		125	91	MS
Cadmium, Total	83 - 114	24.3	1.3		25.0	92	MS
Cadmium, Total	83 - 114	24.2	1.3		25.0	92	MS
Chromium, Total	69 - 130	132.9	16		125	94	MS
Chromium, Total	69 - 130	126.9	16		125	89	MS
Lead, Total	74 - 132	355.3	257		125	79	MS
Lead, Total	74 - 132	384.6	257		125	102	MS
Mercury, Total	73 - 136	0.549	<0.10	U	0.417	132	CV
Mercury, Total	73 - 136	0.557	<0.10	U	0.417	134	CV
Selenium, Total	62 - 126	123.1	1.3		100	122	MS
Selenium, Total	62 - 126	119.7	1.3		100	118	MS
Silver, Total	78 - 115	20.2	<0.20	U	25.0	81	MS
Silver, Total	78 - 115	20.7	<0.20	U	25.0	83	MS

Associated data
Estimate detects:
230760-68, 230587

FIELD DUPLICATE SUMMARY FORM

Site Name:	RMC Beech Grove, IN	Laboratory:	TriMatrix
Project Number:	98-478-03	Case/Order No.:	35132-1 to 3532-27
Sampling Date(s):	8/10-8/26/99, 9/1/99		

Sample description or location	CSB-4B	CSB-4BD		
Sample number	229459	229460		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1000	34	186.85	J
Arsenic	164	25	147.09	J
Barium	123	158	24.91	
Cadmium	102	29	111.45	J
Chromium	13	30	79.07	J
Lead	460000	2450	197.88	J
Mercury	0.23	ND	NA	
Selenium	1.9	1.2	NA	
Silver	0.5	ND	NA	

Sample description or location	CSB-7C	CSB-7CD		
Sample number	229468	229469		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	904	1140	23.09	
Arsenic	343	430	22.51	
Barium	134	113	17.00	
Cadmium	158	163	3.12	
Chromium	16	12	28.57	
Lead	77200	144000	60.40	J
Mercury	0.73	0.61	17.91	
Selenium	12	9.9	19.18	
Silver	1.5	1.9	23.53	

Sample description or location	CSB-9C	CSB-9CD		
Sample number	229484	229485		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1.2	4.3	NA	
Arsenic	7.7	7.4	3.97	
Barium	76	69	9.66	
Cadmium	ND	ND	NA	
Chromium	13	12	8.00	
Lead	53	50	5.83	
Mercury	ND	ND	NA	
Selenium	0.71	0.73	2.78	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

Sample description or location	CSB-10C	CSB-10CD		
Sample number	229493	229494		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	43	4.9	159.08	J
Arsenic	17	8.7	64.59	J
Barium	138	96	35.90	
Cadmium	151	156	NA	
Chromium	20	15	28.57	
Lead	1500	362	122.23	J
Mercury	ND	ND	NA	
Selenium	1.6	0.98	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-15C	CSB-15CD		
Sample number	229765	229766		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	2.3	3.3	35.71	
Arsenic	5.3	6.1	14.04	
Barium	47	51	8.16	
Cadmium	ND	ND	NA	
Chromium	9.6	12	22.22	
Lead	28	30	6.90	
Mercury	ND	ND	NA	
Selenium	ND	ND	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-17C	CSB-17CD		
Sample number	229782	229783		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1.2	1.2	0.00	
Arsenic	6.9	7	1.44	
Barium	53	55	3.70	
Cadmium	0.52	ND	NA	
Chromium	11	10	9.52	
Lead	101	273	91.98	J
Mercury	ND	ND	NA	
Selenium	0.59	0.65	9.68	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.

J - Denotes %RPD outside criteria.

NA - Cannot be calculated or results <5X LOQ.

ND - Not detected.

FIELD DUPLICATE SUMMARY FORM

Sample description or location	CSB-19C	CSB-19CD		
Sample number	230265	230266		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1.4	2.2	NA	
Arsenic	6.7	6.8	1.48	
Barium	47	53	12.00	
Cadmium	1.3	0.66	NA	
Chromium	11	12	8.70	
Lead	129	68	61.93	J
Mercury	ND	ND	NA	
Selenium	1.40	0.75	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-23C	CSB-23CD		
Sample number	230324	230325		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1	ND	NA	
Arsenic	6.2	6.1	1.63	
Barium	42	44	4.65	
Cadmium	ND	ND	NA	
Chromium	8	8.3	3.68	
Lead	32	8	120.00	J
Mercury	ND	ND	NA	
Selenium	ND	0.62	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-28C	CSB-28CD		
Sample number	230299	230300		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1.7	ND	NA	
Arsenic	23	8.7	90.22	J
Barium	534	190	95.03	J
Cadmium	0.83	ND	NA	
Chromium	61	18	108.86	J
Lead	29	10	97.44	J
Mercury	ND	ND	NA	
Selenium	3.40	1.4	83.33	J
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

QA Scientist DMC

Date 12/12/99

Sample description or location	CSB-30C	CSB-30CD		
Sample number	230307	230308		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1	741	199.46	J
Arsenic	11	8.6	24.49	
Barium	97	62	44.03	
Cadmium	ND	ND	NA	
Chromium	21	14	40.00	
Lead	15	24	46.15	J
Mercury	ND	ND	NA	
Selenium	1.00	1.1	9.52	
Silver	ND	ND	NA	

Sample description or location	CSB-34C	CSB-34CD		
Sample number	229958	229959		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1.6	1.6	0.00	
Arsenic	7	6.5	7.41	
Barium	40	44	9.52	
Cadmium	ND	ND	NA	
Chromium	9	9.6	6.45	
Lead	68	86	23.38	
Mercury	ND	ND	NA	
Selenium	ND	0.6	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-35C	CSB-35CD		
Sample number	229972	229971		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	16	15	6.45	
Arsenic	7	7.9	12.08	
Barium	41	45	9.30	
Cadmium	1.2	1.4	NA	
Chromium	7.2	7.7	6.71	
Lead	1400	1120	22.22	
Mercury	ND	ND	NA	
Selenium	0.77	0.68	12.41	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

QA Scientist [illegible] Date 12/22/99

Sample description or location	CSB-39C	CSB-39CD		
Sample number	229984	229985		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	1.4	1.4	0.00	
Arsenic	5.8	9	43.24	J
Barium	44	43	2.30	
Cadmium	ND	ND	NA	
Chromium	9.9	8.4	16.39	
Lead	15	15	0.00	
Mercury	ND	ND	NA	
Selenium	ND	0.54	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-44C	CSB-44CD		
Sample number	229984	229985		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	ND	ND	NA	
Arsenic	7.6	6.2	20.29	
Barium	50	45	10.53	
Cadmium	ND	ND	NA	
Chromium	13	8.7	39.63	
Lead	20	11	58.06	J
Mercury	ND	ND	NA	
Selenium	0.85	1.4	NA	
Silver	ND	ND	NA	

Sample description or location	CSB-47C	CSB-47CD		
Sample number	230568	230569		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	ND	ND	NA	
Arsenic	5.9	6.4	8.13	
Barium	41	43	4.76	
Cadmium	ND	ND	NA	
Chromium	7.7	8.3	7.50	
Lead	10	14	33.33	
Mercury	ND	ND	NA	
Selenium	1.60	0.59	NA	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; $\pm$2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

QA Scientist Dean Mhe Date 12/22/99

FIELD DUPLICATE SUMMARY FORM

Sample description or location	CSB-50C	CSB-50CD		
Sample number	230256	230257		
Matrix	Soil	Soil		
Units	mg/kg	mg.kg		
Parameters			RPD	Q
TOTAL				
Antimony	3.8	2	NA	
Arsenic	10	11	9.52	
Barium	168	33	134.33	J
Cadmium	0.56	ND	NA	
Chromium	32	21	41.51	J
Lead	229	111	69.41	J
Mercury	ND	ND	NA	
Selenium	2.00	1.1	NA	
Silver	ND	ND	NA	

Duplicate criteria: Soil <40% if >5X LOQ; ±2 LOQ if <5X LOQ.
J - Denotes %RPD outside criteria.
NA - Cannot be calculated or results <5X LOQ.
ND - Not detected.

QA Scientist D McC...

Date 2/22/99

WET CHEMISTRY DATA VALIDATION SUMMARY

Site Name: Beech Grove
Project Number: 98-478-03
Sampling Date(s): 8/25

Laboratory: TriMatrix
Case /Order No.: 35132 -20,21,23
CSB43A - CSB47CD, RSB1A - RSE
CSED1A - CSED4B

Parameter List: pH
Method: 9045C

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times			√	Samples were analyzed 2 days after collection - estimated results
Calibration Curve		√		NA
Initial Calibration	√			
Continuing Calibration	√			
Laboratory Control Sample Results	√			
Blank Analysis Results	√			
Duplicate Analysis Results	√			CSB44C + CSB44CD, CSB47C + CSB47CD
Field Duplicate Analysis Results	√			
Matrix Spike Analysis Results		√		NA
Quantitation/Detection Limits	√			
Overall Assessment of Data	√			
Other:				

General Comments:

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased

NA - Not Applicable
NR - Not Reviewed

QA Scientist Megan N. Cloud
Date 11/9/99

WET CHEMISTRY DATA VALIDATION SUMMARY

Site Name: Beech Grove
Project Number: 98-478-03
Sampling Date(s): 8/17, 8/19/99

Laboratory: TriMatrix
Case /Order No.: 35132 - 4,5,6
CSB1A - CSB17CD, CSB20A,B

Parameter List: pH
Method: 9045C (SW-846)

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times			✓	samples analyzed 2 days after collection - estimated all pH's
Calibration Curve		✓		NA
Initial Calibration	✓			
Continuing Calibration	✓			
Laboratory Control Sample Results	✓			
Blank Analysis Results	✓			
Duplicate Analysis Results	✓			
Field Duplicate Analysis Results	✓			CSB4B + CSB4BD, CSB9C + CSB9CD, 15C + 15C CSB7C + CSB7CD, CSB10C + CSB10CD, 17C + 17C
Matrix Spike Analysis Results		✓		NA
Quantitation/Detection Limits	✓			
Overall Assessment of Data	✓			
Other:				

General Comments:

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased

NA - Not Applicable
NR - Not Reviewed

QA Scientist Megan L. Cloud
Date 11/9/99

WET CHEMISTRY DATA VALIDATION SUMMARY

Site Name: Birch Grove
Project Number: 98-478-03
Sampling Date(s): 8/20
Parameter List: pH
Method: 9045C

Laboratory: TriMatrix
Case /Order No.: 35132-8,9
CSB33A - CSB42C, CSB49A,B,C
CSB51A, B, C

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times			✓	Samples analyzed 3 days after collection - Estimated all pH's
Calibration Curve		✓		NA
Initial Calibration	✓			
Continuing Calibration	✓			
Laboratory Control Sample Results	✓			
Blank Analysis Results	✓			
Duplicate Analysis Results	✓			
Field Duplicate Analysis Results	✓			CSB34C + CSB34CD, CSB38C + CSB38CD CSB35C + CSB35CD CSB39C + CSB39CD CSB50C + CSB50CD
Matrix Spike Analysis Results		✓		NA
Quantitation/Detection Limits	✓			
Overall Assessment of Data	✓			
Other:				

General Comments:

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased

NA - Not Applicable
NR - Not Reviewed

QA Scientist Megan N. Cloud
Date 11/9/99

WET CHEMISTRY DATA VALIDATION SUMMARY

Site Name: Beech Grove
Project Number: 98-478-03
Sampling Date(s):

Laboratory: Tri Matrix
Case /Order No.: 35132-13,15,16 CSB18A – CSB19CD, CSB21A – CSB32C

Parameter List: pH
Method: 9045C

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times			√	Samples analyzed 3 days after collection - estimated all Results
Calibration Curve		√		NA
Initial Calibration	√			
Continuing Calibration	√			
Laboratory Control Sample Results	√			
Blank Analysis Results	√			
Duplicate Analysis Results	√			
Field Duplicate Analysis Results				
Matrix Spike Analysis Results		√		NA
Quantitation/Detection Limits	√			
Overall Assessment of Data	√			
Other:				

General Comments:

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased

NA - Not Applicable
NR - Not Reviewed

QA Scientist Megan N. Cloud
Date 11/9/99

APPENDIX C
DATA VALIDATION REPORT FOR FIRST QUARTERLY GROUNDWATER SAMPLING EVENT

DATA VALIDATION REPORT

OF

GROUNDWATER SAMPLES

COLLECTED SEPTEMBER 21, 22, AND 23, 1999

FOR

ORGANIC AND INORGANIC PARAMETERS

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

Laboratory Case Number
35132-26

PREPARED FOR:

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

PREPARED BY:

ADVANCED GEOSERVICES CORP.
CHADDS FORD, PENNSYLVANIA

DECEMBER 16, 1999

PROJECT NUMBER 98-478-03

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Volatiles Data Summary Table
Metals Data Summary Table

ATTACHMENTS

Volatiles Data Support Documentation
Metals Data Support Documentation

1.0 INTRODUCTION

Eight groundwater samples, a field duplicate sample, field blank and equipment blank were collected at the Refined Metals Site in Beech Grove, Indiana, September 21, 22, and 23, 1999 for chemical analyses. The six shallow well samples, field duplicate sample, field blank and equipment blank were analyzed for select volatile compounds and Resource and Conservation Recovery Act (RCRA) metals plus antimony. Additionally, one well sample and a field duplicate sample were field filtered and analyzed for dissolved RCRA metals and antimony. The two deep wells were collected and analyzed for RCRA metals and antimony only. Analyses of these samples were performed by TriMatrix Laboratories of Grand Rapids, Michigan. The sample results are reported under TriMatrix Case Number 35132-26.

The samples were analyzed for the following parameters by the corresponding methodologies:

Analytical Parameter	Methodology
Volatile Organic Compounds (Benzene, Ethylbenzene, 1,1,1-trichloroethane Toluene, and Tetrachloroethene)	SW-846 Method 8260B
RCRA Metals and antimony	SW-846 Method 6020

The data deliverables consisted of a Report of Analysis listing each sample and result, chain-of-custody records, copies of relevant notebook pages and instrument raw data, calibration information, laboratory blank analysis results, and quality control forms that show precision and accuracy data derived from the quality control samples.

2.0 DATA VALIDATION

2.1 Volatile Organic Data

All data generated by TriMatrix were reviewed by an Advanced GeoServices Corp. data validation specialist. Validation was performed for holding time compliance, laboratory method blank and field blank contamination, initial and continuing calibration accuracy, matrix spike/matrix spike duplicate (MS/MSD) recovery and precision, field duplicate precision, and detection limit applicability. Organic data was validated according to the "USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review" (February 1994) and "Region V Standard Operating Procedure for Validation of CLP Organic Data" (August 1993).

Validation was performed to verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. For criteria differences between the functional guidelines and the specific method, the specific method criteria prevailed. Qualifier codes were applied as required. The U qualifier code was applied to all sample results qualitatively questioned due to blank contamination. The U reflects either an adjusted detection limit due to blank contamination or the analyte was not detected at or above the associated instrument detection limit. The J qualifier code was applied to all sample results which are considered quantitative estimates due to exceeding quality control criteria. The UJ qualifier code was applied to all results which were undetected but are estimated due to exceeding quality control criteria.

2.1.1 General

Groundwater samples collected from five locations were analyzed for benzene, toluene, ethylbenzene, tetrachloroethene, and 1,1,1-trichloroethane by SW-846 method 8260B. An associated field duplicate, field blank, equipment blank, and three trip blanks were analyzed for the same parameters as the samples. All holding times were within EPA method requirements. Samples were received at the laboratory at 5°C. Initial calibrations were accurate. All blanks were free of contamination. Surrogate recoveries and internal standard areas were within control limits. Laboratory control sample recoveries were within acceptance criteria. Matrix spike and matrix spike duplicate recoveries were accurate. Field duplicate precision was accurate.

2.1.2 Qualifications

No qualifiers are applied. The data are acceptable as reported.

2.1.3 Comments

The ethylbenzene continuing calibration percent difference (%D) was greater than the acceptance criteria (<20%) for samples MW-3 MS and MW-3 MSD. Since these are QC samples, no qualifiers were applied to these data.

2.2 Metals Data

All data generated by TriMatrix were reviewed by an Advanced GeoServices Corp. data validation specialist. Validation was performed for holding time compliance, laboratory method blank and field blank contamination, initial and continuing calibration accuracy, MS/MSD recovery and precision, field duplicate precision, and detection limit applicability. Inorganic data was validated according to the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (February 1994) and "Region V Standard Operating Procedures for Validation of CLP Inorganic Data" (September 1993).

Validation was performed to verify compliance with the required analytical protocols and to determine the qualitative and quantitative reliability of the data. For criteria differences between the functional guidelines and the specific method, the specific method criteria prevailed. Qualifier codes were applied as required. The U qualifier code was applied to all sample results qualitatively questioned due to blank contamination. The U also denotes the analyte was not detected at or above the associated instrument detection limit. The J qualifier code was applied to all sample results which are considered quantitative estimates due to exceeding quality control criteria. The UJ qualifier code was applied to all results which were undetected but are estimated due to exceeding quality control criteria. The R qualifier code was applied to all sample results which are considered unusable.

2.2.1 General

Eight groundwater samples were collected and analyzed for total arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and antimony by SW-846 method 6020. A field duplicate sample, field blank and an equipment blank were also sampled and analyzed for the same parameters. Additionally, one well was sampled in duplicate, field filtered and analyzed for dissolved arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and antimony. All holding times were within the EPA method requirements. Initial and continuing calibrations were accurate. Laboratory control sample recoveries were within acceptance criteria.

2.2.2 Qualifications

According to Region V criteria, when applying qualification based on blank contamination, results which are greater than the instrument detection limit (IDL) but less than five times the Contract Required Detection Limit (CRDL) are qualified using the following criteria: results less than five times the blank concentration are qualified with the U qualifier code and results greater than five times the blank concentration are qualified with the J qualifier code. The following samples have been qualified due to blank contamination:

> Due to the presence of arsenic in an associated method blank at a similar concentration, the total arsenic result for sample MW-16S (233022) is qualitatively questioned and qualified with the U qualifier code to reflect an elevated detection limit, while the total arsenic result for sample MW-6S (233021) is estimated (J).

Due to the presence of chromium and lead in the associated equipment blank, all results for chromium and lead qualitatively questioned and qualified with the U qualifier code to reflect elevated detection limits.

Due to duplicate injection precision outside the acceptance criteria of 20 relative percent difference (RPD), the total and dissolved selenium results for sample MW-6S (233021) are estimated (J).

Due to extremely low silver MS/MSD recoveries (less than 30%), the following sample silver detection limits are qualified as unusable (R): MW-1 (232806), MW-2D (232801), MW-2S (232802), MW-3 (232878), MW-4 (232879), MW-5 (232880) and MW-6D (232803).

Due to total silver MS/MSD recoveries between 30 and 74%, samples MW-6S (233021) and MW-16S (233022) silver detection limits are estimated (UJ). Additionally, the silver MS/MSD duplicate precision was also outside the acceptance criteria.

2.2.3 Comments

The original sample (MW-6S) and the field duplicate sample (MW-16S) total lead results exceeded the field duplicate criteria. However, both lead results have been qualified due to equipment blank contamination and further qualification is not applicable.

The total and dissolved results for samples MW-6S (233021) and MW-16S (233022) were compared. All dissolved results were less than the associated total results.

3.0 CONCLUSION

This data validation has identified arsenic method blank contamination, lead and chromium equipment blank contamination, duplicate injection precision for selenium in two samples, and silver MS/MSD accuracy and precision as reasons for qualifying the metals data. All other data are acceptable as reported by the laboratory. All data requiring qualification have been addressed in this review and are appropriately qualified on the data summary tables. To confidently use any of the analytical results, the data user should understand the qualifications and limitations stated in this report.

QUALIFIER CODES

R - Denotes an unusable result. The analyte may or may not be present.

U - Denotes the compound/analyte is not present at or above the associated instrument detection limit.

J - Denotes an estimated value.

UJ - Denotes an undetected result that is estimated due to exceeding quality control criteria.

REFINED METALS CORPORATION
BEECH GROVE, INDIANA
SEPTEMBER 1999
GROUNDWATER SAMPLES

Project Name	Beech Grove	Laboratory	TriMatrix Laboratories
Project Number	98-478-03	Case No.	35132-26
Sample Date(s)	9/21,22, & 23/99	Method	EPA Methods 8260B

Sample Location	MW-1			MW-2S			MW-3			MW-4			MW-5			MW-6S		
Lab ID	232806			232802			232878			232879			232880			233021		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	9/21/99			9/21/99			9/22/99			9/22/99			9/22/99			9/23/99		
Comments																		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
1,1,1-Trichloroethane		U	1		U	1		U	1		U	1		U	1		U	1
Benzene		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene		U	1		U	1		U	1		U	1		U	1		U	1
Toluene		U	1		U	1		U	1		U	1		U	1		U	1

Sample Location	MW-16S			MW-6D-FB			MW-6D-EQ			MW-1-TB			MW-5-TB			Trip Blank		
Lab ID	233022			232805			232804			232807			232881			233023		
Matrix	Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Units	mg/kg			mg/kg			mg/kg			mg/kg			mg/kg			mg/kg		
Sample Date	9/21/99			9/21/99			9/21/99			9/21/99			9/22/99			9/23/99		
Comments	FD of MW-6S			Field Blank			Equip. Blank			Trip Blank			Trip Blank			Trip Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
1,1,1-Trichloroethane		U	1		U	1		U	1		U	1		U	1		U	1
Benzene		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene		U	1		U	1		U	1		U	1		U	1		U	1
Toluene		U	1		U	1		U	1		U	1		U	1		U	1

DL -Detection limit.
Q - Qualifier.
U - The compound was not detected at or above the associated quantitation limit.

August1999.xls

QA Scientist Megan N. Cloud Date 12/16/99

REFINED METALS CORPORATION
BEECH GROVE, INDIANA
SEPTEMBER 1999
GROUNDWATER SAMPLES

Project Name	Beech Grove
Project Number	98-478-03
Sample Date(s)	9/21-23/99
Laboratory	TriMatrix Laboratories
Case No.	35132-26
Method	SW-846 6010B & 7470

Sample Location	MW-1			MW-2D			MW-2S			MW-3			MW-4			MW-5		
Lab ID	232806			232801			232802			232878			232879			232880		
Matrix	aqueous			aqueous			aqueous			aqueous			aqueous			aqueous		
Units	ug/l			ug/l			ug/l			ug/l			ug/l			ug/l		
Sample Date	9/21/1999			9/21/1999			9/21/1999			9/22/1999			9/22/1999			9/22/1999		
Comments																		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic	21		1	6.3		1	9.8		1	11		1	1.8		1	8.4		1
Barium	96		10	334		10	40		10	135		10	211		10	149		10
Cadmium		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium	1.8	U	1	5.2	U	1		U	1	1.1	U	1	3.1	U	1	1.5	U	1
Lead	1.8	U	1	10	U	1	11	U	1		U	1	1.7	U	1		U	1
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium	9		2		U	2	7.7		2	5.2		2		U	2		U	2
Silver		R	0.2		R	0.2		R	0.2		R	0.2		R	0.2		R	0.2

Sample Location	MW-6S			MW-6S			MW-6D			MW-16S*			MW-16S*			MW-6D-FB			MW-6D-EQ		
Lab ID	233021			233021			232803			233022			233022			232805			232804		
Matrix	aqueous			aqueous			aqueous			aqueous			aqueous			aqueous			aqueous		
Units	ug/l			ug/l			ug/l			ug/l			ug/l			ug/l			ug/l		
Sample Date	9/21/1999			9/23/1999			9/21/1999			9/21/1999			9/23/1999			9/21/1999			9/21/1999		
Comments				Dissolved									Dissolved			Field Blank			Equipment Blank		
Parameter	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL	Result	Q	DL
Antimony		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Arsenic	8.8	J	1	1.7		1	24		1	7.4	U	1	1.7		1		U	1		U	1
Barium	218		10	39		10	293		10	179		10	39		10		U	10		U	10
Cadmium	0.2		0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Chromium	26	U	1	8.7	U	1	2	U	1	22	U	1	8	U	1		U	1	6.6		1
Lead	21	U	1		U	1	2.2	U	1	14	U	1		U	1		U	1	11		1
Mercury		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Selenium	4.9	J	2	2.9	J	2	2.1		2	5		2	2.6		2		U	2		U	2
Silver		UJ	0.2		U	0.2		R	0.2		UJ	0.2		U	0.2		U	0.2		U	0.2

DL - Detection limit prior to any dilutions.
Q - Qualifier.
R - Denotes a rejected detection limit or result.
U - The analyte was not detected at or above the detection limit.
Result + U - The result is qualitatively questioned due to the analyte in an associated blank at a similar concentration.
The detection limit has been elevated and is reflected by the associated value.
UJ- Denotes an estimated detection limit.
J - Denotes an estimated result.
* Total and dissolved MW-16S samples are field duplicates of total and dissolved MW-6S.

Au[illegible]999.xls

QA Scientist [signature] Date 12/16/99

VOLATILE DATA VALIDATION SUMMARY

Site Name: Beech Grove
Project Number: 99-478-03
Sampling Date(s): 9/21-23/99

Laboratory: TriMatrix
Case/Order No.: 35132-26

Compound List: ☐ TCL ☐ Priority Pollutant ☐ Appendix IX ☒ Other Benzene, Ethylbenzene, Toluene, PCE, 1,1,1-TCA

Method: ☐ CLP SOW 3/90 ☐ 40 CFR 136 ☒ SW-846 Method 8260B ☐ Other ______

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	Accept	FYI	Qualify	Comments
Holding Times	✓			Received @ 5°C in cooler
GC/MS Tuning	✓			Used National guidelines criteria not method criteria
Initial Calibrations	✓			
Continuing Calibrations		✓		Ethylbenzene %D 720 for MW-3 MS/MSD samples
Blank Analysis Results	✓			
System Monitoring/Surrogate Results	✓			
MS/MSD Results	✓			Site-specific (MW-3 MS/MSD)
Field Duplicate Results	✓			MW-6S and MW-16S
Internal Standard Areas/RT	✓			
Target Compound Identification	✓			
TIC Identification		✓		NA
Quantitation/Detection Limits	✓			
System Performance	✓			
Overall Assessment of Data	✓			
Other: LCS	✓			

General Comments: ______

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased.
NR - Not Reviewed
NA - Not Applicable

QA Scientist Megan N. Cloud
Date 11/24/99

Evaluate Continuing Calibration Report Form 7

Data File : I:\VOMS\132\40P1001.D Vial: 0
Acq On : 1 OCT 1999 8:43 Operator:
Sample : Inst :
Misc : Multiplr: 1.00
MS Integration Params: rteint.p

Associated samples:
MW-3-92299 MS
MW-3-92299 MSD

Method : C:\SAT132\QUANT\8260B-11.M (RTE Integrator)
Title : Saturn 132
Last Update : Thu Oct 07 09:52:05 1999
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 30% Max. Rel. Area : 200%

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
1	I	IS: Flourobenzene	1.000	1.000	0.0	102	-0.02
2	T	Dichlorodifluoromethane	0.266	0.138	48.1#	48#	0.00
3	TP	Chloromethane	0.237	0.212	10.5	89	-0.02
4	TC	Vinyl Chloride	0.172	0.153	11.0	83	0.00
5	T	Bromomethane	0.239	0.191	20.1	86	-0.02
6	T	Chloroethane	0.037	0.038	-2.7	98	0.00
7	T	Trichlorofluoromethane	0.473	0.565	-19.5	106	-0.02
8	T	Ethyl Ether	0.164	0.187	-14.0	109	-0.02
9	T	Acrolein	0.017	0.000	100.0#	1#	0.00
10	TCM	1,1-Dichloroethene	0.211	0.229	-8.5	106	-0.02
11	T	Trichlorotrifluoroethane	0.320	0.355	-10.9	103	0.00
[illegible]	T	Iodomethane	0.658	0.706	-7.3	108	0.00
[illegible]	T	Carbon Disulfide	0.398	0.402	-1.0	97	-0.02
14	T	Acetone	0.146	0.227	-55.5#	150	0.00
15	T	Isopropanol	0.012	0.012	0.0	101	-0.01
16	T	Methylene Chloride	0.675	0.719	-6.5	105	-0.02
17	T	Acrylonitrile	0.183	0.001	99.5#	0#	0.03
18	T	trans-1,2-Dichloroethene	0.253	0.293	-15.8	116	0.00
19	T	Methyl(tert)Butyl Ether	0.558	0.613	-9.9	111	-0.02
20	TP	1,1-Dichloroethane	0.282	0.285	-1.1	100	-0.02
21	T	Vinyl Acetate	0.694	0.782	-12.7	110	-0.01
22	T	2,2-Dichloropropane	0.308	0.276	10.4	92	0.00
23	T	cis-1,2-Dichloroethene	0.296	0.304	-2.7	103	-0.02
24	T	Methyl Ethyl Ketone	0.161	0.190	-18.0	123	0.00
25	T	Bromochloromethane	0.510	0.519	-1.8	99	-0.02
26	TC	Chloroform	0.492	0.480	2.4	101	-0.01
27	T	1,1,1-Trichloroethane	0.561	0.574	-2.3	98	-0.01
28	S	SUR: Dibromofluoromethane	0.357	0.312	12.6	95	0.00
29	T	Carbon Tetrachloride	0.507	0.452	10.8	86	0.00
30	T	1,1-Dichloropropene	0.289	0.320	-10.7	109	-0.01
31	TM	Benzene	0.881	0.919	-4.3	105	-0.02
32	T	1,2-Dichloroethane	0.427	0.443	-3.7	104	-0.02
33	T	Heptane	0.346	0.406	-17.3	113	0.00
34	S	SUR: 1,2-Dichloroethane-d4	0.356	0.327	8.1	93	-0.01
35	TM	Trichloroethene	0.301	0.318	-5.6	106	0.00
36	TC	1,2-Dichloropropane	0.167	0.180	-7.8	105	0.00
37	T	Dibromomethane	0.288	0.295	-2.4	100	-0.01
[illegible]	T	Bromodichloromethane	0.415	0.405	2.4	97	-0.02
39	T	2-Chloroethyl Vinyl Ether	0.114	0.117	-2.6	103	1.05#
40	T	cis-1,3-Dichloropropene	0.389	0.418	-7.5	107	-0.01
41	T	4-Methyl-2-Pentanone	0.261	0.249	4.6	100	0.01

(#) = Out of Range

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
BLANKS
USEPA CLP FORM 3

SDG No.	35132 -26	Parameter	Arsenic, Total
Instrument ID	114	Ref. Cit.	EPA-200.8/6020
		Matrix	WATER
		Units	ug/L

Batch	Blank QC Type	Sequence No.	Amount Found
48449	Method Preparation	1	<1.0
48451	Method Preparation	1	1.73

Associated Samples:
233021 + 233022
DJM
12/16/99

Evaluate Continuing Calibration Report

Data File : I:\VOMS\132\40P1001.D Vial: 0
Acq On : 1 OCT 1999 8:43 Operator:
Sample : Inst :
Misc : Multiplr: 1.00
MS Integration Params: rteint.p

Method : C:\SAT132\QUANT\8260B-11.M (RTE Integrator)
Title : Saturn 132
Last Update : Thu Oct 07 09:52:05 1999
Response via : Multiple Level Calibration

Min. RRF : 0.000 Min. Rel. Area : 50% Max. R.T. Dev 0.50min
Max. RRF Dev : 30% Max. Rel. Area : 200%

		Compound	AvgRF	CCRF	%Dev	Area%	Dev(min)
42	S	SUR: d8-Toluene	1.249	1.159	7.2	101	-0.01
43	I	IS: d5-Chlorobenzene	1.000	1.000	0.0	94	-0.01
44	TCM	Toluene	3.604	4.225	-17.2	107	0.00
45	T	trans-1,3-Dichloropropene	0.852	1.000	-17.4	108	0.00
46	T	1,1,2-Trichloroethane	0.453	0.473	-4.4	95	-0.03
47	T	Tetrachloroethene	0.540	0.622	-15.2	103	-0.02
48	T	1,3-Dichloropropane	0.591	0.715	-21.0	120	-0.01
49	T	2-Hexanone	0.449	0.561	-24.9	108	0.00
50	T	Dibromochloromethane	1.058	1.101	-4.1	96	-0.01
51	T	1,2-Dibromoethane	0.929	1.027	-10.5	104	-0.01
52	TPM	Chlorobenzene	1.999	2.514	-25.8	110	-0.02
[illegible]	T	1,1,1,2-Tetrachloroethane	0.782	0.937	-19.8	107	0.00
[illegible]	TC	Ethyl Benzene	3.692	4.456	-20.7#	114	0.00
55	T	m/p-Xylene	3.308	4.129	-24.8	112	-0.01
56	T	o-Xylene	3.494	4.110	-17.6	109	-0.01
57	T	Styrene	2.075	2.409	-16.1	107	0.00
58	TP	Bromoform	0.685	0.681	0.6	96	0.00
59	T	Isopropylbenzene	3.145	3.915	-24.5	114	-0.01
60	S	Sur: 4-Bromofluorobenzene	1.236	1.249	-1.1	97	-0.02
61	I	IS: d4-1,4-Dichlorobenzene	1.000	1.000	0.0	83	-0.01
62	T	1,4-trans-2-dichlorobutene	0.422	0.437	-3.6	93	0.00
63	T	Bromobenzene	1.210	1.508	-24.6	114	-0.02
64	TP	1,1,2,2-Tetrachloroethane	0.756	0.791	-4.6	91	-0.02
65	T	1,2,3-Trichloropropane	1.036	1.133	-9.4	97	0.00
66	T	n-Propylbenzene	3.803	4.801	-26.2	111	-0.01
67	T	2-Chlorotoluene	0.672	0.842	-25.3	112	-0.01
68	T	1,3,5-Trimethylbenzene	2.973	3.718	-25.1	110	-0.02
69	T	4-Chlorotoluene	3.299	4.056	-22.9	109	-0.02
70	T	tert-Butylbenzene	2.062	2.618	-27.0	106	-0.02
71	T	1,2,4-Trimethylbenzene	2.951	3.641	-23.4	107	-0.02
72	T	sec-Butylbenzene	2.860	3.622	-26.6	114	-0.03
73	T	1,3-Dichlorbenzene	1.530	1.814	-18.6	104	0.00
74	T	4-Isopropyltoluene	2.409	3.074	-27.6	119	0.00
75	T	1,4-Dichlorobenzene	1.662	1.891	-13.8	101	-0.02
76	T	1,2-Dichlorobenzene	1.384	1.577	-13.9	94	-0.02
77	T	n-Butylbenzene	2.605	3.123	-19.9	101	-0.02
[illegible]	T	1,2-Dibromo-3-chloropropane	0.240	0.164	31.7#	61	0.00
[illegible]	T	1,2,4-Trichlorobenzene	0.961	0.594	38.2#	55	-0.01
80	T	Hexachlorobutadiene	0.485	0.484	0.2	87	-0.03
81	T	Naphthalene	2.679	1.324	50.6#	43#	-0.01

(#) = Out of Range

UMC 11/24/99

INORGANIC DATA VALIDATION SUMMARY

Site Name: RMC - Beech Grove, In.
Project Number: 98-478-03
Sampling Date(s): 9/21,22,23/99

Laboratory: TriMatrix
Case /Order No.: 35132-26

Compound List: [ ] TAL [ ] Priority Pollutant [ ] Appendix IX [X] Other RCRA + Sb

Method: [ ] CLP SOW ILMO4. [ ] 40 CFR 136 [✓] SW-846 Method [ ] Other ________

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times	✓			
Initial Calibrations	✓			
Continuing Calibrations	✓			
CRDL Standards		✓		Not reviewed
Blank Analysis Results			✓	Equip blk Cont. Cr - 6.6 Pb - 11 ; MBlk - As 1.73
ICP Interference Check Sample Recoveries	✓			
Duplicate Results			✓	Ag MW-16S total MS/MSD 56 RPD
Field Duplicate Results		✓		Lead MW-6S + MW-16S total Pb 40 RPD already
Spike Analysis Recoveries			✓	Ag for all total blk qualified MW-1, MW-3 R, MW-16S J
Serial Dilution Results		✓		not reviewed
Laboratory Control Sample Results	✓			
Furnace AA QC Analysis		✓		NA
Quantitation/Detection Limits	✓			
Overall Assessment of Data	✓			
Other:			✓	Total vs dissolved - ✓ Duplicate injection precision - J 233021 total + dissolved Se

General Comments: Used Region V qualifications for blks with analytes > IDL but < 5X CRDL ; U values < 5X blk + J values > 5X blk.

Accept - No qualification required.
FYI - For your information only, no qualification necessary.
Qualify - Qualify as rejected, estimated or biased
NA - Not applicable.
NR - Not reviewed.

QA Scientist Denise McGowan
Date 12/15/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -26

Sample ID. MW-1-092199

Matrix WATER
Lab Sample No. 232806
Units ug/L

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	70 - 138	1062	<10	U	1111	96	MS
Antimony, Total	70 - 138	1055	<10	U	1111	95	MS
Arsenic, Total	78 - 127	1035	21		1111	91	MS
Arsenic, Total	78 - 127	1065	21		1111	94	MS
Barium, Total	75 - 126	203.4	96		111	97	MS
Barium, Total	75 - 126	206.7	96		111	100	MS
Cadmium, Total	86 - 117	121.9	<0.2	U	111	110	MS
Cadmium, Total	86 - 117	116.8	<0.2	U	111	105	MS
Chromium, Total	71 - 123	115.5	1.8		111	102	MS
Chromium, Total	71 - 123	111.9	1.8		111	99	MS
Lead, Total	83 - 121	116.5	1.8		111	103	MS
Lead, Total	83 - 121	122.1	1.8		111	108	MS
Selenium, Total	73 - 129	1086	9.0		1111	97	MS
Selenium, Total	73 - 129	1074	9.0		1111	96	MS
Silver, Total	69 - 128	22.6	<0.2	U	111	20	MS
Silver, Total	69 - 128	22.7	<0.2	U	111	20	MS

Associated samples:
MW-1, MW-2D,
232806, 232801
MW-2S, MW-6D
232802, 232803
DJM 12/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -26

Sample ID. MW-3-92299MS/MSD

Matrix WATER
Lab Sample No. 232878
Units ug/L

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Total	70 - 138	1046	<10	U	1111	94	MS
Antimony, Total	70 - 138	1053	<10	U	1111	95	MS
Arsenic, Total	78 - 127	1081	11		1111	96	MS
Arsenic, Total	78 - 127	1064	11		1111	95	MS
Barium, Total	75 - 126	237.9	135		111	93	MS
Barium, Total	75 - 126	247.9	135		111	102	MS
Cadmium, Total	86 - 117	104.4	<0.2	U	111	94	MS
Cadmium, Total	86 - 117	105.2	<0.2	U	111	95	MS
Chromium, Total	71 - 123	111.8	1.1		111	100	MS
Chromium, Total	71 - 123	110.2	1.1		111	98	MS
Lead, Total	83 - 121	111.1	<1.0	U	111	100	MS
Lead, Total	83 - 121	112.8	<1.0	U	111	102	MS
Mercury, Total	73 - 135	3.00	<0.2	U	2.50	120	CV
Mercury, Total	73 - 135	2.55	<0.2	U	2.50	102	CV
Selenium, Total	73 - 129	1090	5.2		1111	98	MS
Selenium, Total	73 - 129	1055	5.2		1111	94	MS
Silver, Total	69 - 128	24.7	<0.2	U	111	22	MS
Silver, Total	69 - 128	25.6	<0.2	U	111	23	MS

Associated Samples
232878, 232879 +
232880
DJM 12/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
SPIKE SAMPLE RECOVERY
USEPA CLP FORM 5A

SDG No. 35132 -26

Sample ID. MW-16S-092399

Matrix WATER
Lab Sample No. 233022
Units ug/L

Analyte	Control Limit %R	Spiked Sample Result	Sample Result		Spike Added	%R	M
Antimony, Dissolved	70 - 138	976.0	<10	U	1000	98	MS
Antimony, Dissolved	70 - 138	956.7	<10	U	1000	96	MS
Antimony, Total	70 - 138	1007	<10	U	1111	91	MS
Antimony, Total	70 - 138	1126	<10	U	1111	101	MS
Arsenic, Dissolved	78 - 127	2755	1.7		2500	110	MS
Arsenic, Dissolved	78 - 127	2858	1.7		2500	114	MS
Arsenic, Total	78 - 127	1045	7.4		1111	93	MS
Arsenic, Total	78 - 127	1068	7.4		1111	95	MS
Barium, Dissolved	75 - 126	145.9	39		100	107	MS
Barium, Dissolved	75 - 126	142.5	39		100	104	MS
Barium, Total	75 - 126	283.1	179		111	94	MS
Barium, Total	75 - 126	296.9	179		111	106	MS
Cadmium, Dissolved	86 - 117	104.3	<0.2	U	100	104	MS
Cadmium, Dissolved	86 - 117	103.3	<0.2	U	100	103	MS
Cadmium, Total	86 - 117	110.8	<0.2	U	111	100	MS
Cadmium, Total	86 - 117	103.5	<0.2	U	111	93	MS
Chromium, Dissolved	71 - 123	103.1	8.0		100	95	MS
Chromium, Dissolved	71 - 123	105.9	8.0		100	98	MS
Chromium, Total	71 - 123	134.3	22		111	101	MS
Chromium, Total	71 - 123	141.7	22		111	108	MS
Lead, Dissolved	83 - 121	104.9	<1.0	U	100	105	MS
Lead, Dissolved	83 - 121	106.8	<1.0	U	100	107	MS
Lead, Total	83 - 121	135.2	14		111	109	MS
Lead, Total	83 - 121	131.8	14		111	106	MS
Selenium, Dissolved	73 - 129	1133	2.6		1000	113	MS
Selenium, Dissolved	73 - 129	1165	2.6		1000	116	MS
Selenium, Total	73 - 129	1166	5.0		1111	105	MS
Selenium, Total	73 - 129	1066	5.0		1111	95	MS
Silver, Dissolved	69 - 128	224.0	<0.2	U	250	90	MS
Silver, Dissolved	69 - 128	240.4	<0.2	U	250	96	MS
Silver, Total	69 - 128	61.0	<0.2	U	111	55	MS
Silver, Total	69 - 128	34.4	<0.2	U	111	31	MS

Associated samples:
233021 + 233022
BMM
12/17/99

TriMatrix Laboratories, Inc.

QUALITY CONTROL REPORT
MATRIX SPIKE DUPLICATE
USEPA CLP FORM 6

SDG No. 35132 -26

Sample ID. MW-16S-092399

Matrix WATER
Lab Sample No. 233022
Units ug/L

Analyte	Control Limit	Sample Result	Duplicate Spike Result	RPD	M
Antimony, Dissolved	0 - 20	976.0	956.7	2	MS
Antimony, Total	0 - 20	1007	1126	11	MS
Arsenic, Dissolved	0 - 20	2755	2858	4	MS
Arsenic, Total	0 - 20	1045	1068	2	MS
Barium, Dissolved	0 - 20	142.5	145.9	2	MS
Barium, Total	0 - 20	283.1	296.9	5	MS
Cadmium, Dissolved	0 - 20	103.3	104.3	1	MS
Cadmium, Total	0 - 20	103.5	110.8	7	MS
Chromium, Dissolved	0 - 20	105.9	103.1	3	MS
Chromium, Total	0 - 20	134.3	141.7	5	MS
Lead, Dissolved	0 - 20	106.8	104.9	2	MS
Lead, Total	0 - 20	131.8	135.2	3	MS
Selenium, Dissolved	0 - 20	1165	1133	3	MS
Selenium, Total	0 - 20	1066	1166	9	MS
Silver, Dissolved	0 - 20	224.0	240.4	7	MS
Silver, Total	0 - 20	34.4	61.0	56	MS

Associated samples:
233021 + 233022
total Silver
DJM 12/17/99

CLOSURE PLAN

PREPARED FOR:

REFINED METALS CORPORATION

BEECH GROVE, INDIANA

(EPA ID. IND000718130)

VERSION 1.0

OCTOBER 12, 1998

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project Number: 98-478-02

J: \REFINED METALS\DRAWINGS\9847801\98478-00

ADVANCED GEOSERVICES CORP. "Engineering for the Environment"™

Chadds Ford Business Campus
Rts. 202 & 1, Brandywine One - Suite 202
Chadds Ford, PA 19317-9676
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October 12, 1998 98-478-02

Mr. Thomas Linson, Branch Chief
Indiana Department of Environmental Management
Office of Solid & Hazardous Waste Management Branch
105 S. Meridian Street
Indianapolis, IN 46206-6015

RE: Refined Metals Corporation Site
Beech Grove, IN
Closure Plan

Dear Ms. Eifert:

On behalf of Refined Metals Corporation (RMC), Advanced GeoServices Corp. (AGC) submits the enclosed Closure Plan for the RMC Site in Beech Grove, IN pursuant to Section VI, Item 37 of the Consent Decree.

Please call either myself at (610) 558-3300 or Matt Love (Exide Corporation) at (610) 378-0500 if you have any questions regarding this submittal.

Sincerely,

ADVANCED GEOSERVICES CORP.

Paul G. Stratman, P.E.
Project Manager

PGS:lld

Enclosure

cc: Matt A. Love, Exide Corporation
Robert N. Steinwurtzel, Esq., Swidler & Berlin
John Adanuga, USEPA
U.S. Department of Justice

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CLOSURE PLAN

REFINED METALS CORPORATION SITE

Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

Project No. 98-478-02
October 12, 1998

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CERTIFICATION STATEMENT

"I certify under penalty of perjury that the information contained in or accompanying this (submission) (document) is, to the best of my knowledge after thorough investigation, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

PAUL STRATMAN SENIOR PROJECT CONSULTANT 10-12-98

Print Name & ~~Title~~

Date

Paul Stratman

Signature

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1.0 INTRODUCTION

1.1 GENERAL SITE DESCRIPTION

The Refined Metals Corporation (RMC) facility in Beech Grove, Indiana (Site) was the location of secondary lead smelting operations from 1968 through 1995. The location of the Site is shown on Figure 1-1. The Site ceased normal operations on December 31, 1995. The Site, as shown of Figure 1-2, covers approximately 24 acres which includes approximately 10 acres where smelting operations occurred. The remainder of the Site consists of areas of lawn and woods. The former smelter area contains several structures identified as the Battery Breaker, Material Storage, Furnace, Refining, Waste Water Treatment/Filter Press, and Office Buildings. Other smaller structures exist including a vehicle maintenance building, baghouses, and pump houses.

During its operating life, the facility handled materials which were classified as hazardous materials or hazardous wastes under the Resource Conservation and Recovery Act (RCRA). These primarily consisted of lead bearing materials that were processed for lead recovery. In accordance with the requirements of RCRA, the facility completed and submitted a RCRA permit application. On November 19, 1980 the facility was granted approval to operate two hazardous waste management units under Interim Status: 1) indoor waste piles; and 2) outdoor waste piles. Facility documents also identify a lined lagoon as a RCRA permitted unit; however, it does not appear to have been included on the Facility Part A permit until after 1991. The lagoon was, and still is used, to collect facility storm water runoff. See Figure 1-3 for the location of three Solid Waste Management Units (SWMUs).

At this time, the Site is idle except for the waste water treatment system which remains in operation. The waste water treatment system remains in-place to collect and treat storm water runoff from the lined lagoon and other site areas. The indoor and outdoor waste piles have been removed.

1.2 PURPOSE

On July 14, 1998 Refined Metals Corporation entered into a Consent Decree with the United States Environmental Protection Agency (EPA) and the Indiana Department of Environmental Management (IDEM), Civil Action No. IP902077C. The technical objectives of the Consent Decree are as follows:

1. Effectuate closure of waste piles and surface impoundment by submitting a closure plan and post-closure plan, if necessary, and then to implement the plan(s) as approved;

2. Perform a RCRA Facility Investigation (RFI) to evaluate and determine the full nature and extent of releases and collect information necessary to support a Corrective Measures Study, or Interim Measures;

3. Perform Interim/Stabilization Measures to abate threats to human health and the environment;

4. Perform a Corrective Measures Study to develop and evaluate alternatives and to recommend a final corrective measure(s); and

5. Perform Corrective Measures.

Pursuant to Section VI, Paragraph 37 of the Consent Decree (Compliance Requirements for Closure), Advanced GeoServices Corp. (AGC) has prepared this Closure Plan on behalf of RMC for the three SWMUs on-site. This Closure Plan has been prepared in accordance with Indiana Department of Environmental Management (IDEM) Hazardous Waste Management Unit Closure Guidance (Waste-0013-ND) and Risk Assessment Addendum.

1.3 CLOSURE PERFORMANCE STANDARD

The Closure Plan has been developed with the intent to utilize existing information and propose the collection of additional information necessary to determine the potential presence, magnitude, extent and mobility of hazardous waste and hazardous waste constituents on and beneath the former RCRA permitted hazardous waste and solid waste management units at the Site. The information cited in this plan was developed using the Consent Decree, information provided by RMC employees, and files and reports identified in a review of facility environmental files. In addition, the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP) developed as part of the RCRA Facility Investigation Work Plan (dated August 27, 1998) are included as part of this plan.

The Closure Performance Standard for the Site will be the following in accordance with 40 CFR 265.111:

> The owner or operator must close the facility in a manner that:
> (a) Minimizes the need for further maintenance, and
> (b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and
> (c) Complies with the closure requirements of this subpart, including, but not limited to, the requirements of §§265.197, 265.228, 265.258, 265.280, 265.310, 265.351, 265.381, 265.404, and 264.1102 of 40 CFR.

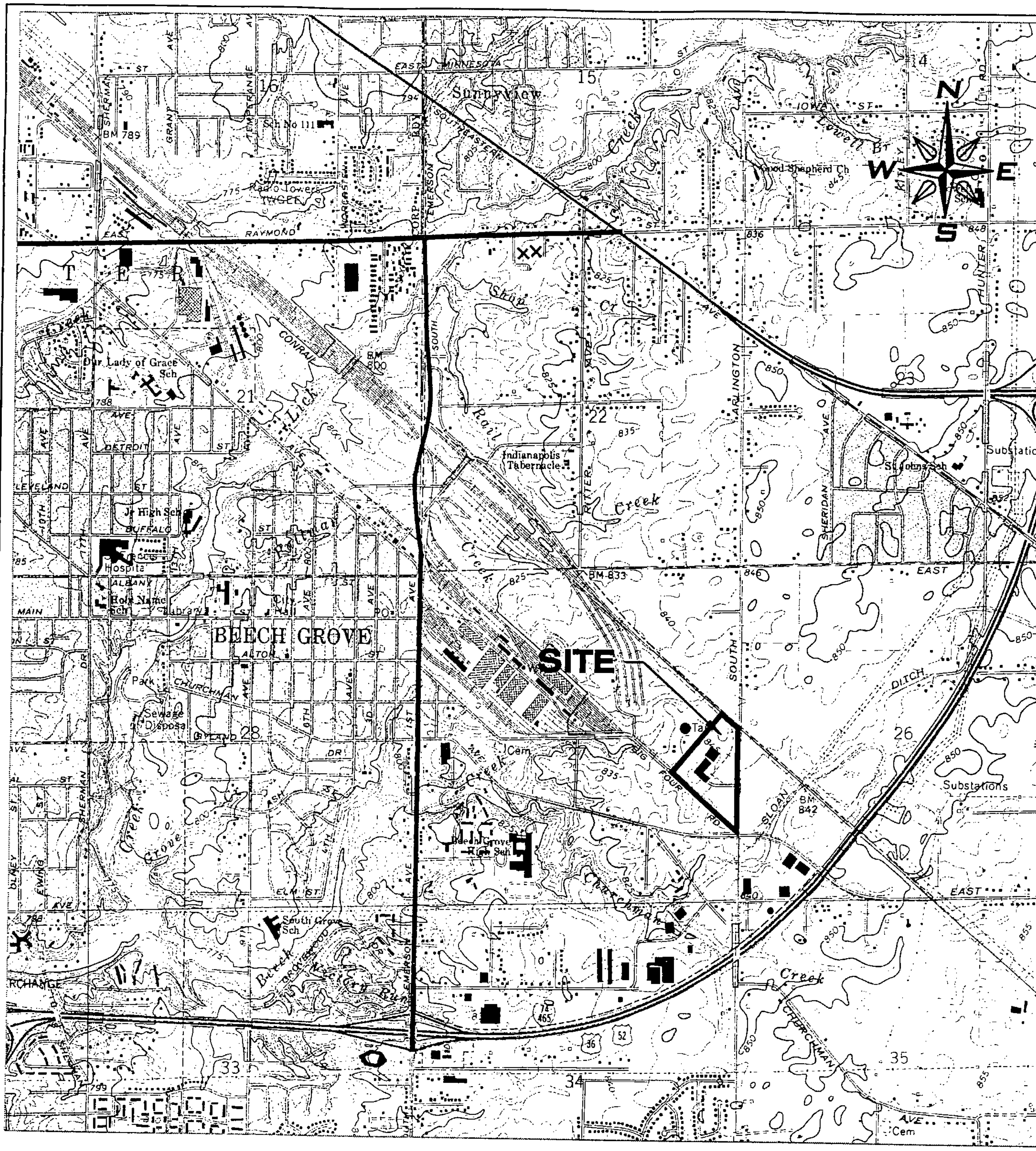
1.4 WORK PLAN ORGANIZATION

This Closure Plan contains a description of current conditions and the waste management units and a sampling and analysis plan. This document is organized as follows:

- Section 1.0 - General Introduction provided above;
- Section 2.0 - Facility Background, including its operating history and regulatory status;
- Section 3.0 - Description of Solid Waste Management Units to be closed;
- Section 4.0 - Containment Descriptions for each unit on-site;
- Section 5.0 - Air Emissions, including a summary of recent monitoring result;
- Section 6.0 - Personnel Safety and Fire Prevention;
- Section 7.0 - Closure Schedule;
- Section 8.0 - Decontamination of Tanks, Equipment and Structures, description of the conceptual procedures to be used;
- Section 9.0 - Cleanup Levels;
- Section10.0 - A summary of the nature and extent of contamination based on existing information;
- Section 11.0 - The proposed Sampling and Analysis Program to be conducted under the scope of this Closure Plan;
- Section 12.0 - Description of Soil Remediation Activities;
- Section 13.0 - Disposal Unit Closures;
- Section 14.0 - Description of Equipment Cleaning;
- Section 15.0 - Closure and Post-Closure Cost Estimates; and
- Section 16.0 - Financial Assurance.

1.5 DISCLAIMER

Portions of this document, related to facility history and operation are based on documents and oral information provided RMC. AGC has not independently verified this information. While the information presented is believed to be accurate to the best of our knowledge, AGC cannot guarantee the completeness or accuracy of the information supplied.



REF. U.S.G.S. 7 1/2 MINUTE
BEECH GROVE, IND
QUADRANGLE MAP

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

Date: 10/12/98	SITE LOCATION MAP
Scale: N.T.S.	
Drawn By: P.S.G.	
Checked By: S.W.K.	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-01	
Issued: OCT 12 1998	Project No. 98-478-02 — FIGURE: 1-1

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2.0 FACILITY BACKGROUND

2.1 FACILITY DESCRIPTION

The RMC facility is situated at 3700 South Arlington Avenue in Marion County, Beech Grove, Indiana, approximately four miles south southeast of downtown Indianapolis. The Site occupies approximately 24 acres, of which approximately 10 acres represented the active manufacturing area. The configuration of the Site is triangular, bounded by Arlington Avenue (oriented in a north to south direction representing the hypotenuse), Big Four Road (along the base) and the common property line with a natural gas company forming the third side. The northwest end of the triangle is truncated by a railroad right-of-way.

The Site is relatively flat with less than 10 feet of total relief. Natural site drainage is towards the north and east. The former manufacturing area is characterized by nearly 80,000 sf of structures which house the battery breaker, a waste water treatment plant, a filter press, material storage areas, a blast furnace, a dust furnace, a metals refining area, warehouse and offices. In addition, there are four baghouses, a vehicle maintenance structure, and five storm water pump houses.

The ground surface surrounding the buildings is currently paved (primarily with concrete). Older facility photographs indicate that areas northwest and northeast of the main facility structure were un-paved except for a concrete driveway which encircled the facility. The paved surface areas are sloped to drain toward catch basins situated around the Site. The catch basins in-turn flow to the storm water pump houses that convey collected storm water to the waste water treatment plant for processing. Drainage from the southeastern areas of the Site is currently conveyed to the 600,000 gallon stormwater and fire control lagoon (one of the three SWMUs on-site). Figure 2-1 shows the surface water drainage features on-site and for the nearby off-site areas.

2.2 OWNERSHIP HISTORY

The Site was reportedly undeveloped woodlands until 1968. In 1968 the property was developed as a lead acid battery reclamation/secondary lead smelter (SIC #3341) by National Lead. National Lead operated the facility from 1968 through 1980, when it was sold to Exide Corporation. In 1985, the Site was purchased from Exide Corporation by Refined Metals Corporation (RMC). RMC continued to operate the facility until the cessation of operations on December 31, 1995. From April 14, 1995, through December 31, 1995, operations were reduced to enriching and casting lead ingots from off-specification lead products. Since 1996, no production has taken place. Today the facility is idle except for operation of the waste water treatment facility which is still used to treat storm water runoff from the former manufacturing areas. The warehouse area is also currently being used to temporarily store re-manufactured starters and alternators (in boxes and on pallets) from a nearby automotive parts facility.

2.3 OPERATIONAL HISTORY

2.3.1 Smelting

The facility was constructed as a secondary lead smelter to recycle lead-acid batteries and other lead bearing wastes. Auto batteries constituted 90 percent of the materials recycled, and the remainder was waste material from battery manufacturers and other lead scrap. Prior to 1984, battery crushing was performed off-site at other commercial facilities. In 1984, the battery breaker was constructed on-site. During post-1984 operations, the batteries were temporarily stored in trailers or on pallets in a paved storage yard. The batteries were then fed into the battery crusher where the tops of the batteries were sawed off and the sulfuric acid was collected in a sump and transferred into a stainless steel tank that drained to the wastewater treatment system. The battery casings and their contents were tumbled and crushed. Lead plates and other lead parts were separated and transported to waste piles to be later fed into the furnace. The battery casings were shredded and separated into plastic and ebonite in a flotation tank. The plastic was blown into a trailer for sale to an offsite recycler.

Ebonite casings were placed in a separate waste pile and then fed into the blast furnace as a supplemental fuel.

One blast furnace and one dust furnace were used at the facility. During operation, the blast furnace used coke and oxygen-enriched air for heating. Liquid oxygen was stored in a 10,000-gallon tank located north of the blast furnace building. Scrap iron was added to the blast furnace to remove sulfur. During the smelting process, molten lead would form at the bottom of the furnace, and the slag would float to the top. The slag was poured into ingots and solidified before being sent off-site for disposal. The dust furnace used natural gas and oxygen-enriched air to melt baghouse dust, which was then fed into the blast furnace.

2.3.2 Refining

Molten lead from the blast furnace was tapped from the bottom of the furnace to kettles in the adjacent refining and casting area. In the kettles, the molten lead was tested to determine its quality. Antimony and tin were either added or removed to create the required lead type and quality. A list of principle materials used on-site is provided in Table 2-1. Removal of antimony and tin was performed by adding sodium hydroxide or through oxidation. If the lead contained excess copper it was removed through the addition of red phosphorus. The excess antimony, tin, copper and other impurities formed as a dross on top of the molten lead and was removed through skimming. The dross was returned to the blast furnace. The refined lead was typically cast into 60-pound bars that were cooled, extracted and stacked for shipment off-site.

The refining kettles were situated with their tops approximately at floor level in the refining and casting building. The bottom of the kettles extended below grade into a sub-floor area. The kettles were heated by natural gas burners located in the sub-floor area. A process flow diagram for the smelting and refining process is presented as Figure 2-2.

2.4 SURROUNDING LAND USE

The Site is surrounded by several different land uses. Figure 2-1 shows the surrounding land use, zoning, and property occupants. A railroad spur is located north of the Site and a refrigerated warehouse (United Refrigerated Services Inc.) is located across the railroad tracks. A Firestone facility which manufactures roofing materials is located east of the Site across Arlington Avenue. A vacant commercial building is also located to the east, and homes and farmland are located northeast of the railroad spur. A mixture of vacant and industrial properties lie to the south of the Site, including Wavetech circuit breaker plant, Universal Machine and Tool Works, and various warehouses. The Beech Grove High School is located 0.75 mile southwest of the Site. A Citizens Gas storage facility and pipeline are located northwest of the Site, and a railroad yard and repair facility for Conrail and Amtrak are located beyond Citizens Gas towards the northwest.

The following facilities, located within a 0.5 mile radius of the Site, are listed on CERCLIS:

1. Holcomb & Hoke Manufacturing Co., Inc., 1545 Van Buren Street;
2. Glass Containers Corp., 1301 2. Keystone Avenue;
3. Keer-McGee Chem Corp-Forest Pro Division, 1450 South Earhart Street;
4. Emerson Avenue Landfill, 2700 S. Emerson Avenue;
5. No Name, 4300 West Southport Road;
6. Indiana Farm Bureau Co-op, 1901 S. Shemann Drive; and
7. Anchor Galvanizing, 3300 Prospect Avenue.

A former production well is located on-site as shown on Figure 1-2. Specific details on the well construction are not known.

2.5 REGULATORY HISTORY

2.5.1 RCRA

As stated above, following the promulgation of RCRA, the facility submitted a Part A RCRA permit application. On November 19, 1980 the facility was granted Interim Status as a hazardous waste treatment, storage and disposal facility. The RCRA Subtitle C units included indoor and outdoor waste piles (used to store batteries and lead-bearing wastes). Facility documents also identify a lined lagoon as a RCRA permitted unit; however, it does not appear to have been included on the Facility Part A permit until after 1991. The lagoon was, and still is used, to collect facility storm water runoff. A Part B application was submitted during the mid-1980s, although full RCRA permitted status was never granted.

RMC submitted a revised Part A application on October 26, 1988 requesting an increase in the storage volume for spent batteries from 200 cy to 400 cy on September 20, 1989. A subsequent revised Part A application was submitted to Indiana Department of Environmental Management (IDEM) on December 7, 1990 for increasing the storage volume of spent batteries from 400 cubic yards to 500 cubic yards. IDEM denied the increase. RMC filed for a stay and was granted interim status to store 400 cy. IDEM approved the revised Part A application on June 3, 1991, with the provision that it did not grant interim status under RCRA. The Part B application was not resubmitted. In 1994, the facility withdrew its Part A and Part B permit applications.

2.5.2 CERCLA

A site inspection was performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in 1980. In 1985 a preliminary assessment was performed under CERCLA. No further action was planned under CERCLA at that time.

2.5.3 State and Local Permits

Waste Water Discharge Permit

A City of Indianapolis Permit to Discharge Waste Water to the Municipal Sewer System (Permit #334103) was issues on May 1, 1993. On January 6, 1994, Refined Metals was informed that they were no longer required to sample for pH, arsenic, lead, zinc, and antimony, and a monthly self-monitoring report was no longer required under their permit to discharge waste water.

Air Permits

The Beech Grove facility originally had ten certificates of operation No. 08025 through 08034 for its seven refinery kettles and three baghouses (M-1 through M-3). The permits were issued by the Air Pollution Control Section of the City of Indianapolis Department of Public Works. The permits expired in December 1987. RMC continued to submit annual administrative fees to the Air Pollution Control Division, per an agreement with the City, after the permits expired.

RMC received approval for a fugitive dust control program from the City on July 15, 1991.

Installation Permit (#910036-01) was issued by the City of Indianapolis on September 11, 1991 for a total enclosure building to house the blast and dust furnace which were vented to a new baghouse, M-4. The seven refinery kettles were also vented through baghouse M-4. The allowable emissions of lead were 0.30 pounds per hour (lb/hr).

RMC submitted on August 26, 1994 an Operating Permit and Construction Permit application to the Indianapolis Air Pollution Control Section for fuel combustion - gas, oil, blast furnace, secondary lead smelter, dust furnace, blast furnace, metallurical baghouse (M-1), blast furnace sanitary baghouse (M-2), sanitary baghouse (M-4), and refinery sanitary baghouse (M-3).

The City of Indianapolis re-issued the facility's Operating Permit, facility number 0036 on January

12, 1995 for the following:

0036-01	M-1	Allowable: Total suspended particulate - 0.003 gr/dscf, 2.8 ton/yr Lead - 0.91 lb/hr, 3.99 ton/yr Sulfate 64.8 lb/hr
0036-02	M-2	Allowable: Total suspended particulate - 0.0005 gr/dscf, <1 ton/yr Lead - 0.015 lb/hr, 0.66 ton/yr
0036-03	M-3	Allowable: Total suspended particulate - 0.03 gr/dscf Lead - 0.015 lb/hr, 0.66 ton/yr
0036-04	M-4	Allowable: Total suspended particulate - 0.03 gr/dscf Lead - 0.3 lb/hr, 1.31 ton/yr

On January 10, 1995, RMC entered into an Agreed Order with IDEM to address Clean Air Act violations.

An Installation Permit (950036-01) was issued on May 22, 1995 to install a natural gas-fired afterburner and scrubber to baghouse M-1. The allowable emissions were as follows:

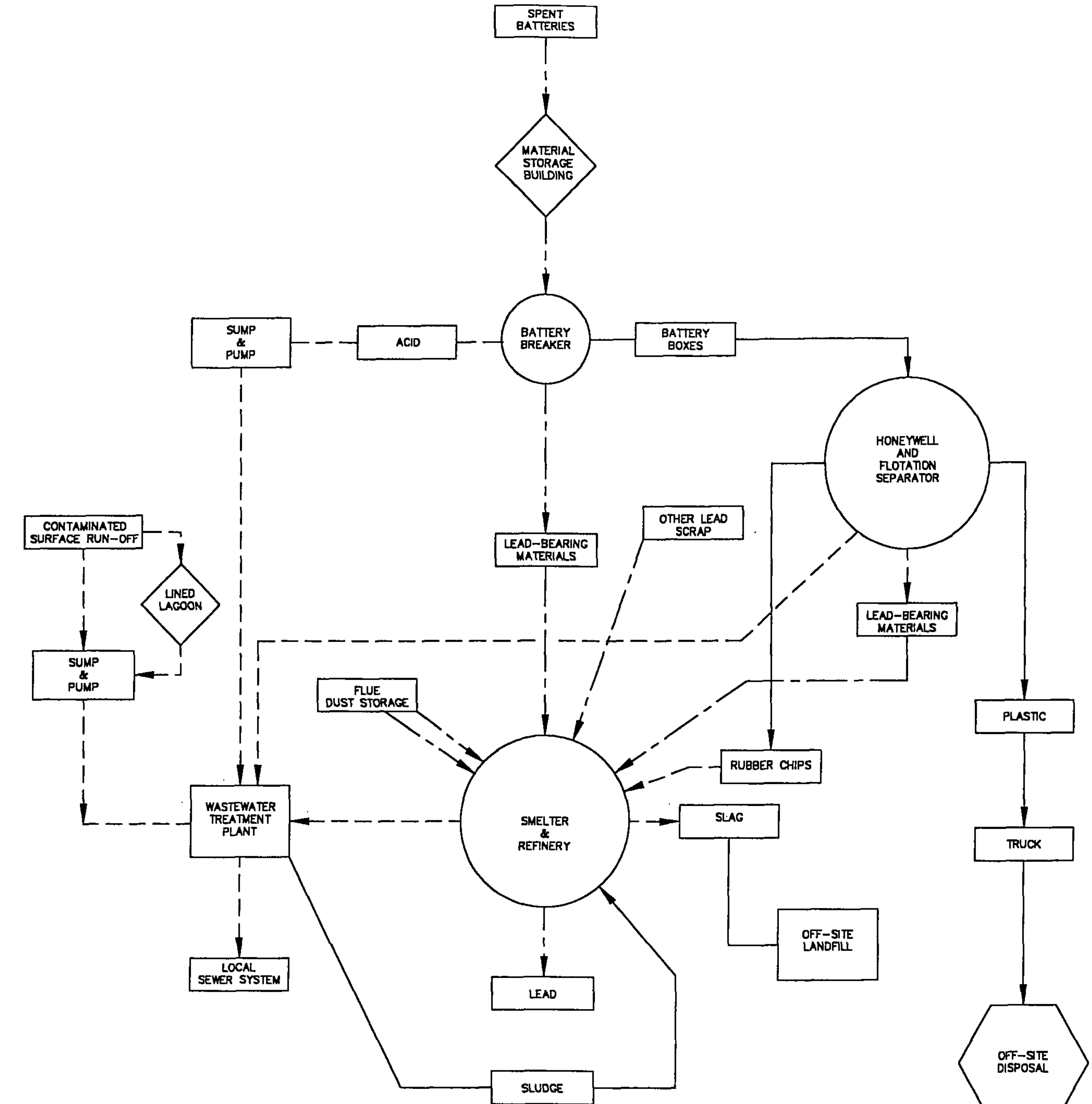
Total suspended particles - 0.003 gr/dscf, or 2.8 ton/yr
Lead - 0.91 lb/hr, or 3.99 ton/yr
Sulfate - 64.8 lb/hr, 283.82 ton/yr, or 10.8 lb sulfate/ton of material discharged.

A revised Construction Permit (950036-01) for M-1 afterburner and scrubber was granted on May 23, 1995.

TABLE 2-1

Principle Materials Used On-Site
Refined Metals Facility
Beech Grove, Indiana

Material	Use
Lead batteries and scrap metal	Raw material for refining
Coke	Furnace fuel
Oxygen	Furnace oxidant
Natural gas	Furnace fuel
Antimony and tin	Alloys added to lead
Sodium hydroxide	Removal of antimony and tin in refining kettles
Red phosphorus	Removal of copper from refining kettles
Scrap iron	Furnace additive to remove sulfur
Magnesium hydroxide	Wastewater neutralization and flocculent
Polymers and chelating agents	Wastewater treatment
Muriatic (hydrochloric) acid	Cleaning wastewater filter press
Lime and sodium bicarbonate	Neutralizing spills



LEGEND

- - - - - - MATERIAL FLOW
— — — — — LIQUID WASTE FLOW
———————— SOLID WASTE FLOW

MATERIALS

REGULATED FACILITY

PROCESSES

REMOVAL FROM PLANT PROPERTY

Date: 10/12/98	PROCESS FLOW DIAGRAM
Scale: N.T.S.	
Drawn By: P.S.G.	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Checked By: S.W.K.	
Project Mgr: P.G.S.	
Dwg No. 98478-02	
Issued: OCT 1 2 1998	Project No. 98-478-02 — FIGURE: 2-2

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3.0 SOLID WASTE MANAGEMENT UNITS TO BE CLOSED

3.1 OUTDOOR WASTE PILES

Reportedly, the outdoor waste pile areas most used were primarily located to the west and north of the Material Storage Building (MSB). Additional areas designated as outdoor waste piles are located on the southeast and northeast side of the MSB, along the south and west side of the Warehouse, and the west corner of the parking lot. The location of the outdoor waste piles are shown on Figure 1-2; however the exact dimensions of the outdoor waste piles are unknown. The process waste code for the outdoor waste piles was SO3.

The outdoor waste piles consisted of 90% lead plates and parts from automobile batteries, and 10% waste material from battery manufactures and other lead scrap. The USEPA hazardous waste number for the lead was D008. The material was staged outside and later fed into the blast furnace. The exact capacity, maximum inventory, and total volume of the unit over the life of the facility could not be quantified based on a file review performed by AGC; however, the most recent Part A applications indicated the maximum design capacity for spent batteries was 15,000 cubic yards. At the present time the outdoor waste piles are gone.

A limited amount of broken plastic battery casings were found in an unpaved area along the northwest side of the property. This area has a poor vegetative cover. Drainage from the area is poorly defined and may, during extreme rainfall events, be a source of runoff to the adjacent off-site area.

3.2 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

The indoor waste piles were located in the MSB (see Figure 1-2). The MSB is approximately 180 feet by 180 feet with a concrete floor of unknown thickness. Conflicting information indicates the MSB was constructed during or prior to 1984. The process waste code for the MSB was SO6. The walls and roof are primarily sheet metal. Holes in the walls were sealed with a polyurethane-type foam to reduce potential airborne releases from the waste piles. The concrete floors are heavily corroded in some areas. No floor drains were visible during previous site visits by AGC. Three operating entrances to the building exist: 1.) vehicle entrance in the north corner which connects directly to the Battery Breaker Building; 2.) vehicle entrance from the outside on the west side of the building; and 3.) internal doorway on the south side which connects directly to the Blast Furnace Building. In addition, three sealed vehicle entrances were noted on the east and south exterior walls of the MSB.

The indoor waste piles consisted of 90% lead plates and parts from automobile batteries, and 10% waste material from battery manufacturers and other lead scrap. The USEPA hazardous waste number for the lead was D008. The material was stored in different bins within the building until later fed into the blast furnace. The exact capacity, maximum inventory, and total volume of the unit over the life of the facility could not be determined; however, the most recent Part A applications indicated the maximum design capacity for spent batteries was 4,600 cubic yards. The indoor waste piles have been removed. Dust and dirt (presumably former furnace feed material) remains on the floor with up to several inches in some areas.

3.3 LINED LAGOON

The lined lagoon is located southwest of the main manufacturing buildings and has been in operation throughout the duration of the manufacturing operations. The lagoon is approximately 0.4 acres and has a capacity of 600,000 gallons. The process code for the lagoon is SO4.

Prior to 1984, the lagoon received runoff from the outdoor waste piles. Stormwater was allowed to evaporate and when the lagoon was full, allowed to overflow. The lagoon's original overflow channel was located on the southern side. The overflow channel discharged to a swale which ran along the northern side of the entrance driveway and to the stormwater swale along Arlington Avenue. In 1984, the existing waste water treatment plant was constructed. During this period, a concrete sump with a level-controlled pump was installed in the lagoon to prevent overflowing. Water in the lagoon was periodically pumped to the wastewater treatment plant and subsequently discharged to the POTW.

The lined stormwater lagoon was reportedly last cleaned out during 1996. RMC continues to operate the lagoon for the purpose of managing stormwater runoff which is ultimately treated through the waste water treatment system. Limited amounts of sediment appear to have accumulated since the last cleaning and cattails are growing in the bottom. An RMC representative at the Site reported that the lagoon is managed to prevent overtopping and the subsequent discharge to off-site surface drainage features.

4.0 CONTAINMENT DESCRIPTIONS

4.1 OUTDOOR WASTE PILES

Prior to 1984, the outdoor waste piles were located on paved and unpaved areas and had minimal spill/containment and runoff control. Storm water runoff from the piles and other work areas flowed and/or was pumped to the storm water lagoon where it was allowed to evaporate and when the lagoon was full, allowed to overflow and drain off-site towards the east. A portion of the drainage from the active manufacturing area flowed uncontrolled toward the north. After the MSB was constructed, the outdoor waste piles were moved inside (i.e., indoor waste piles). Reportedly, material was occasionally stored outside after 1984 when the MSB was full.

The current paved exterior surface areas covering the former outdoor waste piles can be described as broom clean with only a few isolated low spots where small amounts of sediment have accumulated. The pavement is primarily concrete with some asphalt. The pavement is in good condition. These areas are within the portions of the facility where stormwater runoff is collected and treated, prior to discharge to the local POTW.

As previously discussed a limited amount of broken plastic battery casings were found in an unpaved area along the northwest side of the property. This area has a poor vegetative cover. Drainage from the area is poorly defined and may, during extreme rainfall events, be a source of runoff to the adjacent off-site area.

4.2 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

The containment features of the MSB consist of the concrete floors, and sheet metal walls and roof. No secondary containment system exists. The floor was noted to be in fair to poor condition, with reinforcing steel exposed in several areas. The roof was experiencing minor leaking. There were no signs that the dust and dirt on the floor was leaving the building. In addition, no floor drains were observed.

4.3 LINED LAGOON

The lagoon was originally earthen lined and used for the storage of non-contact cooling water During the early 1980's, the lagoon was lined with concrete of unknown thickness and used for storage of site stormwater. In 1988, the lagoon was cleaned out and a geomembrane liner was installed over top of the concrete. The exact type of geomembrane and installation procedures used are unknown; however, based on the October 1, 1998, the geomembrane appears to be either a Hypalon or PVC type material. The condition of the concrete and geomembrane liners are unknown due to the presence of water, sediment, and wetlands-type vegetation within the lagoon, with the exception of several areas along the lagoon top of embankment where the geomembrane was torn.

5.0 AIR EMISSIONS

When the facility was in operation, the primary air emissions at the Site were lead, particulates, and sulfur dioxide. Other emissions were from burning natural gas and odors from battery crushing. Equipment modifications installed in late 1992 and building sealing activities performed in 1994 reduced downwind airborne lead concentrations to below the federal ambient lead standard of 1.5 $\mu g/m^3$.

In 1993, the federal standard was met for the last three quarters. Data for 1994 indicate that the facility had been out of compliance the first two quarters and in compliance the last two quarters. In 1995, the facility was in compliance the first 11 months of the year. The data for December was not available. RMC reportedly discontinued operation of its monitoring station at the end of 1995 in conjunction with the shutdown of the facility. However, the City of Indianapolis reportedly continues to operate its station. Available data from the City's station indicates the facility did not exceed the federal standard in 1996. More recent data was not available; however, air emissions are no longer believed to represent a potential pathway because the facility is inactive.

The proposed Closure investigation activities are not anticipated to result in an increase in airborne emissions; therefore, no control measures are planned. Building decontamination activities for the MSB will require dust suppression measures to minimize air emission. A detailed plan will be developed as part of the future building decontamination work plan addendum to the Closure Plan.

6.0 PERSONNEL SAFETY AND FIRE PREVENTION

The Health and Safety Plan, developed as part of the RFI Work Plan, will be used as part of this Closure Plan and is provided in Appendix B. This Health and Safety Plan will be followed by all personnel conducting sampling activities at the Site. An addendum to the Closure Plan will be developed and submitted, as necessary, to address potential future remedial action and decontamination closure activities.

7.0 CLOSURE SCHEDULE

The proposed closure schedule is shown on Figure 7-1. Future modifications of the Closure schedule may be requested to allow the Corrective Action and Closure activities to be performed concurrently in a cost-effective manner.

CLOSURE PLAN IMPLEMENTATION SCHEDULE
FOR
REFINED METALS CORPORATION
BEECH GROVE, INDIANA FACILITY

TASK	DAYS
IDEM & USEPA CLOSURE PLAN APPROVAL	0 *
PERFORM SOIL, DUST, AND SEDIMENT SAMPLING	45
LABORATORY ANALYSIS	60
DATA VALIDATION	40
INVESTIGATION REPORT (WITH SPECIFICATIONS AND FIGURES)	60
IDEM & USEPA REVIEW/APPROVAL OF INVESTIGATION REPORT	15
UNIT DECONTAMINATION (AS REQUIRED BY INVESTIGATION REPORT)	45
RESTORATION	15
CERTIFICATE OF CLOSURE PREPARATION	60

Timeline (days): 30 60 90 120 150 180 210 240 270 300 330

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REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

Date: 10/12/98	SCHEDULE
Scale: N.T.S.	
Drawn By: V.E.N.	Advanced GeoServices Corp.
Checked By: S.W.K.	Chadds Ford Business Campus, Rts. 202 & 1
Project Mgr: P.G.S.	Brandywine One, Suite 202
Dwg No. 97478-15	Chadds Ford, Pennsylvania 19317
Issued: OCT 1 2 1998	Project No. 97-478-02 FIGURE: 7-1

8.0 DECONTAMINATION OF TANKS, EQUIPMENT AND STRUCTURES

8.1 OUTDOOR WASTE PILES

Decontamination of the Outdoor Waste Piles will be performed to meet the Closure Performance Standards in Section 1.4. The conceptual plan for decontamination includes the following:

- Removal of loose dust and residues from ground surface using hand tools. This material which may have high levels of lead will be sent off-site for recycling or landfilling;
- Seal all cracks and expansion joints and install containment collection features for rinse waste, as necessary;
- Clean concrete paving using high pressure, low volume water washing equipment;
- Collect all rinsate, treat in on-site waste water treatment plant, and discharge to local POTW;
- All surfaces will then be triple rinsed and the rinsate collected and treated on-site;
- Soil remediation will be addressed as necessary.

8.2 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

Decontamination of the MSB will be performed to meet the Closure Performance Standard in Section 1.4. The conceptual plan for decontamination includes the following:

- Removal of loose dust and residues from the floor, walls and structural steel using a vacuum truck and sealed roll off boxes. This material which is likely to have high levels of lead will be sent off-site for recycling;

- Construct measures to divert and collect rinsate.

- Clean interior of the MSB (including all horizontal and vertical surfaces) using high pressure, low volume water washing equipment;

- Collect rinsate and subsequently treat at on-site wastewater treatment plant and then discharge to the local POTW;

- All surfaces will then be triple rinsed and the rinsate collected and treated on-site;

- The concrete floor will be demolished, and sent off-site for either recycling or landfill disposal;

- Miscellaneous equipment and debris not suitable for recycling/resource recovery will be sent off-site for landfill disposal; and

- Soil remediation will be addressed as necessary.

8.3 LINED LAGOON

Decontamination of the lined lagoon will be performed to meet the Closure Performance Standards in Section 1.4. The conceptual plan for decontamination includes the following:

- De-activate stormwater pumping sumps to prevent runoff from entering lagoon;

- Remove standing water for treatment in the on-site wastewater treatment plant and subsequent discharge to local POTW;

- Remove sediment and vegetative material, test, and either recycle or landfill off-site;

- Pressure wash synthetic liner to remove remaining sediment and loose material;

- Remove rinsate along with remaining sediments, treat at on-site waste water treatment plant, and discharge to local POTW;

- Remove liner and dispose off-site in accordance with applicable regulations;

- Seal cracks and expansion joints;

- Triple rinse concrete liner. Collect rinsate and treat at on-site waste water treatment plant then discharge to local POTW;

- Demolish concrete liner, test, and either stockpile for use during backfilling of former lagoon or landfill off-site as appropriate based on testing results and applicable regulations. Concrete liner may be broken-up in place or results holes drilled through it to allow for drainage prior to backfilling based on testing results; and

- Soil remediation will be addressed as necessary.

9.0 CLEANUP LEVELS

The Consent Decree identified lead and cadmium as the hazardous constituents of concern which may be present and migrate from the Site. Initial soil and sediment lead and cadmium concentrations will be compared to the IDEM Tier 1 cleanup goals. If the Site concentrations exceed the Tier 1 goals, Tier 2 and/or a Tier 3 site-specific evaluation(s) will be performed to develop alternative cleanup goals.

Cleanup levels for rinsate generated during decontamination and/or remedial action activities will be the Maximum Contaminant Levels (MCLs) of the National Primary Drinking Water Regulations (40 CFR 141) and 40 CFR 264.94 (a) (2) for inorganics with MCLs. Rinsate exceeding the cleanup levels will be treated on-site in the existing waste water treatment plant prior to discharge to the POTW.

10.0 NATURE AND EXTENT OF KNOWN CONTAMINATION

10.1 BEHAVIOR OF LEAD

A number of the materials formally used at the facility have toxic characteristics, however; the principal material of concern is lead. Lead is a common metal. Lead can be found at an average concentration in excess of 30 ppm in natural soils and 1-10 ug/l in surface water. Most lead salts are fairly insoluble in water. The solubility depends on the pH, with solubility increasing in more acidic conditions. Movement of lead in soils depends on its adsorption, chelation with organic matter, and the precipitation of the less soluble salts. In general, lead reacts with soil anions or clays to form insoluble complexes, inhibiting its mobility. Lead can be ingested or absorbed by inhalation. Poisoning from acute exposure to lead is uncommon. The primary toxic effects from chronic exposure are on the blood and the nervous system.

10.2 SUMMARY OF PREVIOUS SAMPLING ACTIVITIES

During the preparation of the Closure Plan, AGC performed a review of RMC files to identify previous sampling activities. Through that review it was determined that previous sampling of environmental media at the facility was limited to an investigation of soils and building interiors performed by ENTACT, Inc. during April 1996 within both the indoor and outdoor waste piles and quarterly groundwater sampling performed since June 1991. ENTACT also performed sampling in areas outside of the three SWMUs. Information and results for the soil samples collected by EPA, as referenced in the Consent Decree, could not be located. A discussion of the interior samples and soil samples from the SWMUs and groundwater sampling activities and results are provided below.

10.2.1 Outdoor Waste Piles

During its investigation, ENTACT focused exterior soil sampling efforts on four areas including:

Area 1) The visible former battery casing storage area on the northwest side of the Site behind the baghouses (outdoor waste piles);

Area 2) The areas around the baghouses and material storage building that were unpaved until the late 1980s or early 1990s;

Area 3) Grassy areas surrounding the wastewater treatment lagoon; and

Area 4) The grassy and wooded areas between the interior and perimeter fences.

A total of 34 locations outside of the buildings were sampled; however, only three locations (i.e., locations 03, 04, and 05) were within the limits of the outdoor waste piles. Figures 10-4 through 10-6 shows the soil lead concentrations at the locations within the outdoor SWMUs and locations nearby.

No soil samples were collected at the surface at the three locations within the outdoor waste piles SWMUs because the existing surface is paved. Three soil samples were collected at the surface (i.e., 0-4"), within 50 ft. of the outdoor waste piles, and had soil lead concentrations of 923 ppm, 19,654 ppm and 70,406 ppm. Three surface samples collected immediately beneath the pavement (i.e., 4"-12") within the outdoor wastepile perimeter had soil lead concentration range from non-detect to 22,793 ppm. Two subsurface samples (i.e., >1' bgs) near the outdoor waste piles had soil lead concentrations of non-detect and 457 ppm.

10.2.2 Indoor Waste Piles (Material Storage Building)

Samples of floor sweepings were collected from the floors and soil samples were collected from beneath the MSB floor. The samples were analyzed in the field for lead using an XRF by ENTACT. A geoprobe unit was used to collect the soil samples from beneath the floors.

Samples of floor sweepings (4) from the MSB floor ranged in concentrations of lead from 81,220 to 115,736 ppm. Four out of five surface soil samples collected from 1 foot below ground surface (bgs) ranged from non-detectable to 397 ppm; the fifth sample (M1) had a lead concentration of 75,373 ppm. Subsurface soil samples were collected below the highest concentration (i.e., sample M1) at 2 and 8 feet bgs and indicated results of 405 and 173 ppm, respectively. Four additional subsurface samples collected at 4 feet bgs had soil lead concentrations between non-detectable and 93 ppm. The XRF screening results indicated that, with the exception of the area near sample M1, the surface and subsurface soil beneath the MSB floor had lead concentrations within the range of the draft IDEM industrial land use Tier 1 surface (900 ppm) and subsurface (81 ppm) soil cleanup values discussed during the October 1, 1998 Closure Plan scoping meeting. The ENTACT results are shown on Figures 10-1 through 10-3 and Table 10-1.

10.2.3 Lined Lagoon

No samples were collected from within the lagoon SWMU; however, three locations within 50 ft. of the lagoon were sampled from 0-4" and 4"-12". The surface sample lead concentrations ranged from non-detect to 14,034 ppm.

10.2.4 Groundwater

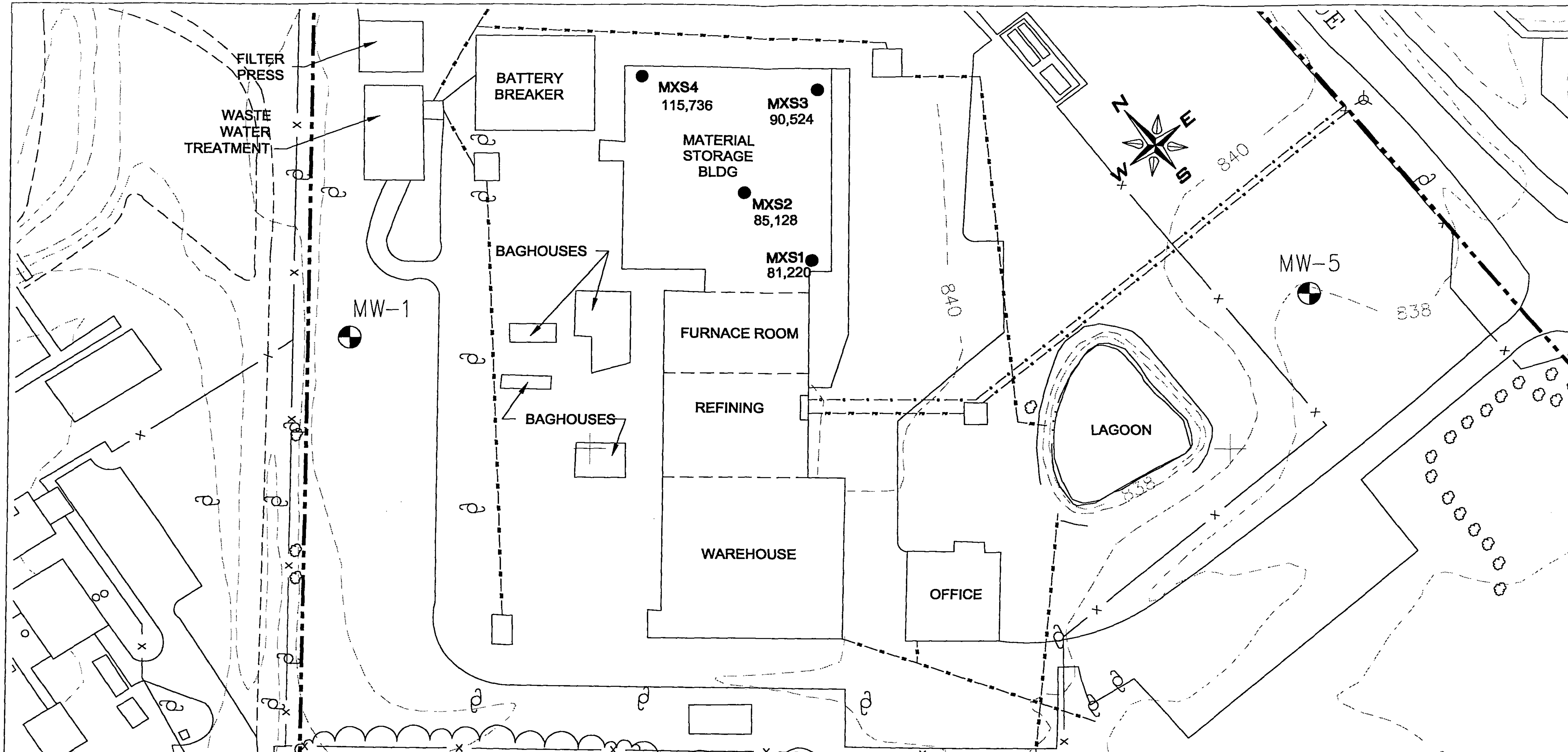
Groundwater samples were collected on a fairly consistent quarterly basis from June 1991 through March 1997. Samples were analyzed for total and dissolved antimony, arsenic, cadmium, lead, and sulfate, pH, conductivity, and turbidity. In general, concentrations of metals in filtered groundwater are below the corresponding MCL or action level. The action level for lead (0.015 mg/l) was exceeded in unfiltered samples collected from MW-2 on June 12, 1991 (0.021 mg/l) and September 30, 1992 (0.022 mg/l). One filtered sample collected from MW-2 on September 17, 1996 indicated a concentration of 0.042 mg/l; however, the unfiltered sample collected on that date did not exceed the action level. An unfiltered sample collected from MW-3 on December 27, 1996 indicated a concentration of 0.016 mg/l of lead. The MCL for arsenic (0.05 mg/l) was exceeded in a sample from MW-3 on March 27, 1992 (0.17 mg/l), and was exceeded slightly in MW-5 on June 13, 1992 (0.057 mg/l). Downgradient monitoring well MW-4 did not detect metals above the MCLs.

Additional groundwater evaluations are planned as part of the RFI Work Plan. At this time, no specific groundwater investigation(s) for the individual SWMUs is planned. A more detailed description of the on-site groundwater quality and flow is provided in the RFI Work Plan. A separate groundwater investigation work plan for the SWMUs will be developed in the future, if necessary.

Table 10-1
ENTACT XRF Lead Results

Sample Number	Depth (ft)	Results (ppm)
Material Storage Building - Interior Floor Samples		
MXS1	S	81,220
MXS2	S	85,128
MXS3	S	90,524
MXS4	S	115,736
Material Storage Building - Interior Subsurface Soil Samples		
M1-1	1	75,373
M1-2	2	405
M1-8	8	173
M2-1	1	54
M2-4	4	0
M3-1	1	397
M3-4	4	0
M4-1	1	0
M4-4	4	63
M5-1	1	0
M5-4	4	93
Exterior - Soil Samples within or near Outdoor SWMUs		
E0	S	923
G0	S	3,351
G12	1	20
H0	S	3,163
H12	1	58
I0	S	14,034
I12	1	0
Y0	S	70,406
Y24	2	457
01-1	1	0
01-4	4	87
03-1 (1)	1	0
03-4 (1)	4	0
04-1 (1)	1	22,793
04-4 (1)	4	0
05-2 (1)	2	20,556
05-3 (1)	3	0
06-1	1	19,654
06-3	3	0

(1) Sample within SWMU
S - Surface
0 - Not detected



LEGEND

• MXS1	SAMPLE LOCATION
115,736	XRF RESULT (PPM)
MW-3	GROUNDWATER MONITORING WELLS
— - —	PROPERTY BOUNDARY
—x—x—x—	FENCE

80 0 80 160

SCALE IN FEET

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE. SAMPLES WERE COLLECTED AND ANALYZED BY ENTACT, DURING APRIL, 1996

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

Date: 10/12/98
Scale: 1"=80'
Drawn By: P.S.G.
Checked By: S.W.K.
Project Mgr: P.G.S.
Dwg No. 98478-06
Issued: OCT 1 2 1998

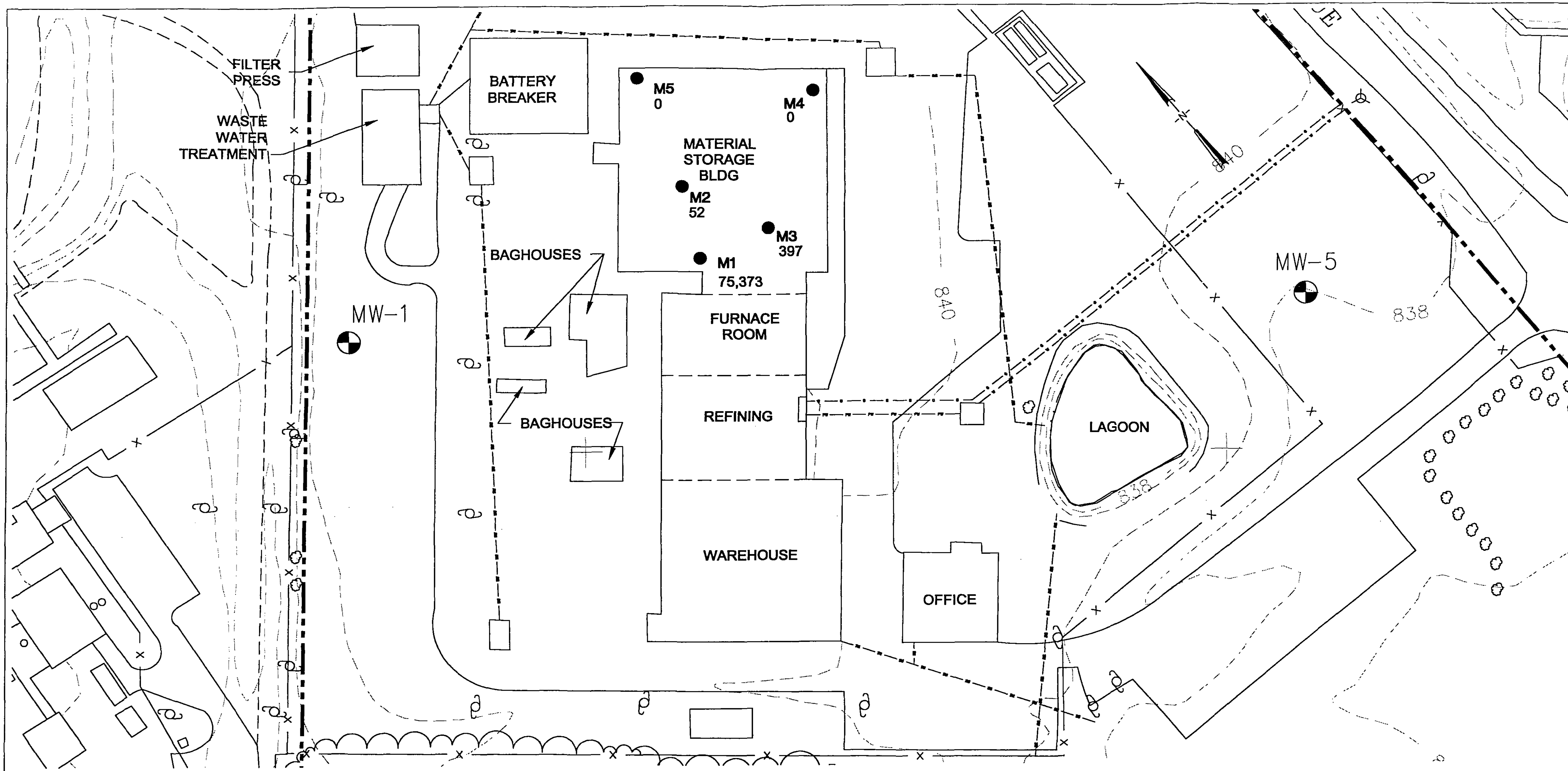
CONCENTRATIONS OF LEAD (PPM) IN FLOOR SAMPLES FROM MATERIAL STORAGE BUILDING

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-02

FIGURE: 10-1

J:\REFINED METALS\DRAWINGS\9847802\98478-06



LEGEND

• M3	SAMPLE LOCATION
397	XRF RESULT (PPM)
0	NON-DETECTABLE XRF RESULT
MW-3	GROUNDWATER MONITORING WELLS
	PROPERTY BOUNDARY
—x—x—x—	FENCE

80 0 80 160

SCALE IN FEET

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE. SAMPLES WERE COLLECTED AND ANALYZED BY ENTACT, DURING APRIL, 1996

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

CONCENTRATIONS OF LEAD (PPM) IN INTERIOR SURFACE (1FT) SOIL SAMPLES FROM MATERIAL STORAGE BUILDING

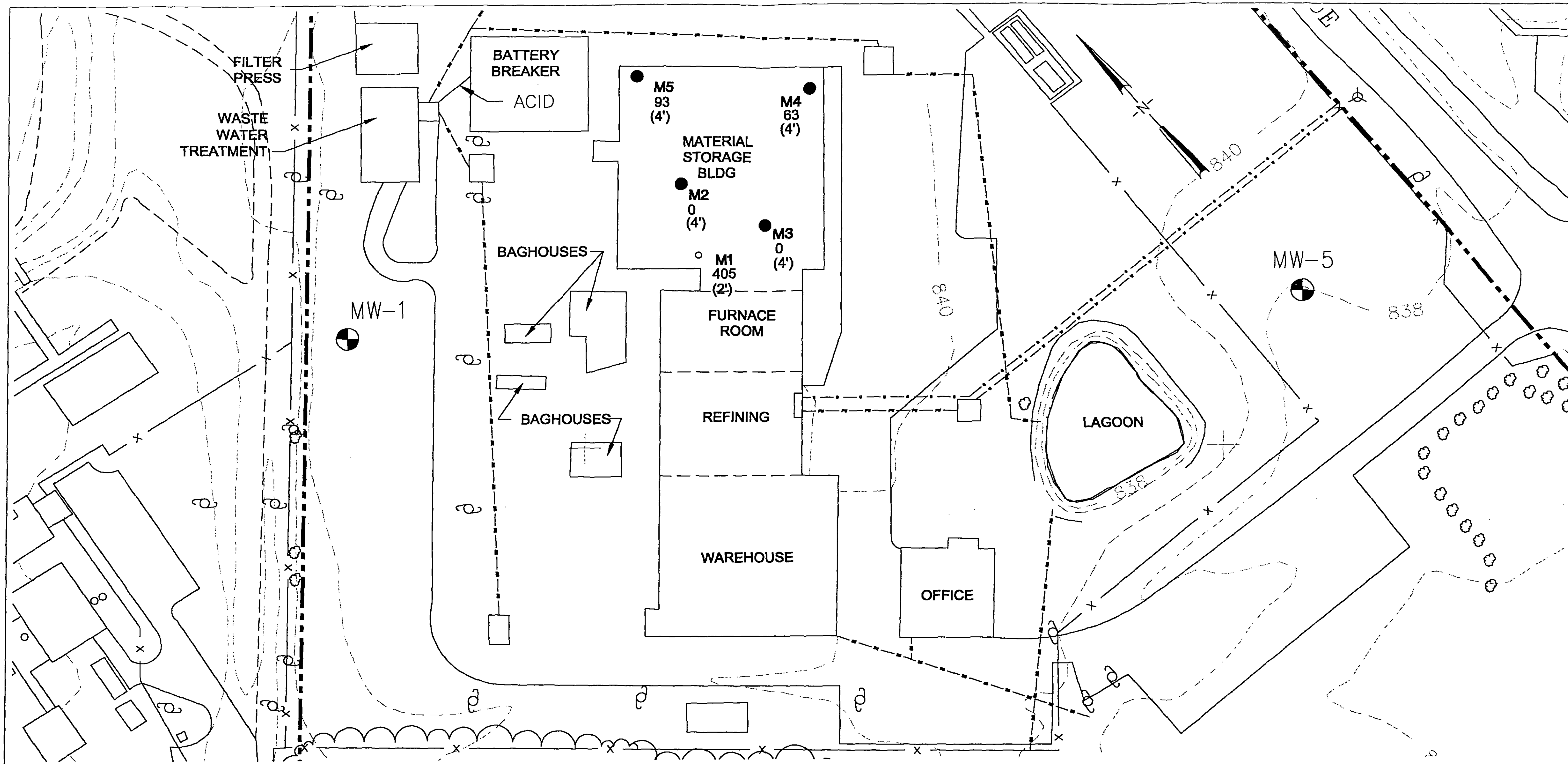
Date: 10/12/98
Scale: 1"=80'
Drawn By: P.S.G.
Checked By: S.W.K.
Project Mgr: P.G.S.
Dwg No. 98478-07
Issued: OCT 1 2 1998

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-02

FIGURE: 10-2

J:\REFINED METALS\DRAWINGS\9847802\98478-07



LEGEND

• M1	SAMPLE LOCATION
53	XRF RESULT (PPM)
0	NON-DETECTABLE XRF RESULT
(4')	SAMPLE DEPTH
MW-3	GROUNDWATER MONITORING WELLS
	PROPERTY BOUNDARY
	FENCE

80 0 80 160

SCALE IN FEET

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE. SAMPLES WERE COLLECTED AND ANALYZED BY ENTACT, DURING APRIL, 1996

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

CONCENTRATIONS OF LEAD (PPM) IN INTERIOR SUBSURFACE (2-4 FT) SOIL SAMPLES FROM MATERIAL STORAGE BUILDING

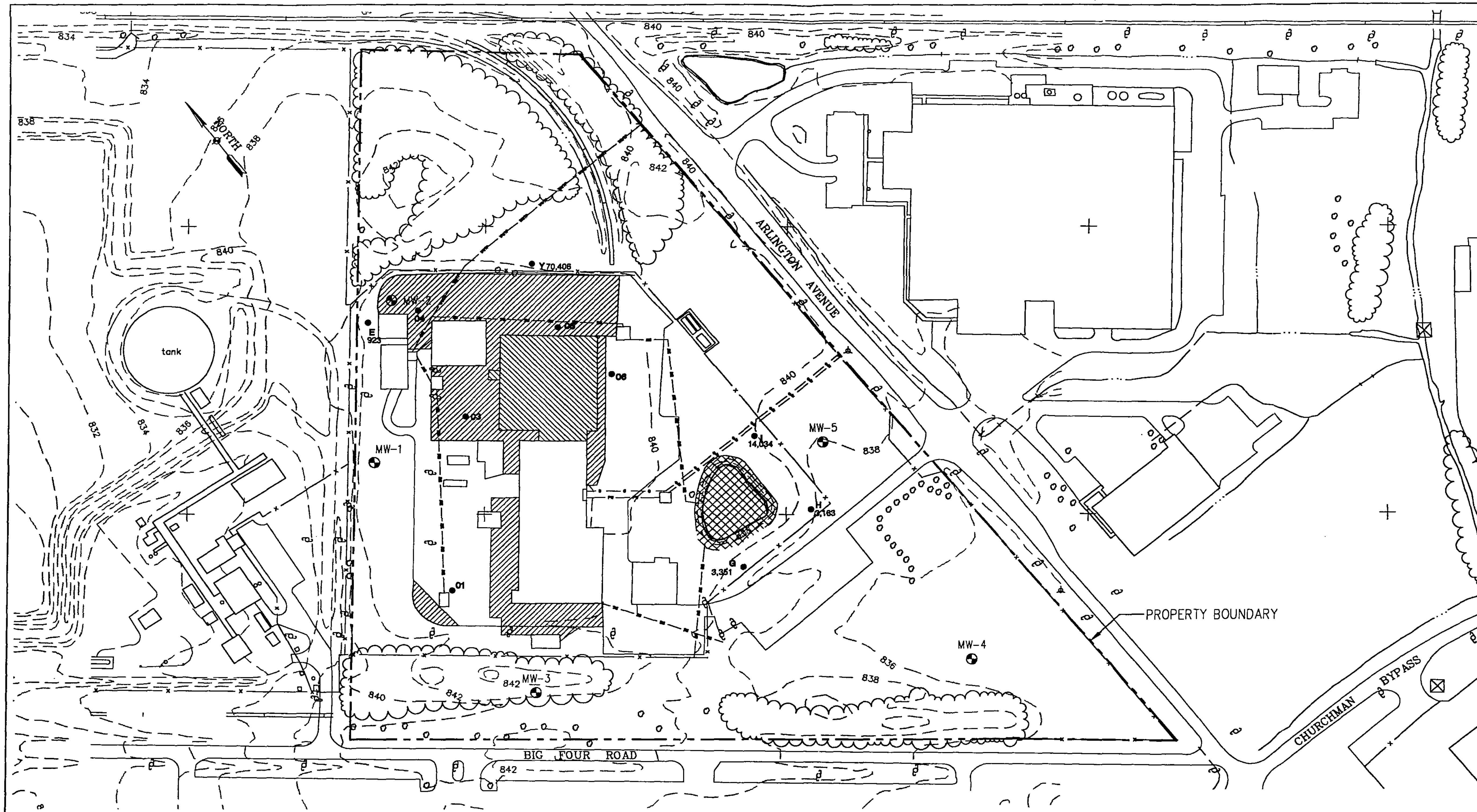
Date: 10/12/98
Scale: 1"=80'
Drawn By: P.S.G.
Checked By: S.W.K.
Project Mgr: P.G.S.
Dwg No. 98478-08
Issued: OCT 1 2 1998

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-02

FIGURE: 10-3

J:\REFINED METALS\DRAWINGS\9847802\98478-08



LEGEND

● A 16,576	SAMPLE LOCATION XRF RESULT (PPM)
	OUTDOOR WASTE PILES
	INDOOR WASTE PILES
	LINED SURFACE WATER IMPOUNDMENT
MW-3	GROUNDWATER MONITORING WELLS
	PROPERTY BOUNDARY
	FENCE

180 0 180 360

SCALE IN FEET

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE. SAMPLES WERE COLLECTED AND ANALYZED BY ENTACT, DURING APRIL, 1996

J:\REFINED METALS\DRAWINGS\9847802\98478-09

REFINED METALS CORPORATION CLOSURE PLAN

BEECH GROVE, INDIANA

Date: 10/12/98

Scale: 1"=180'

Drawn By: P.S.G.

Checked By: S.W.K.

Project Mgr: P.G.S.

Dwg No. 98478-09

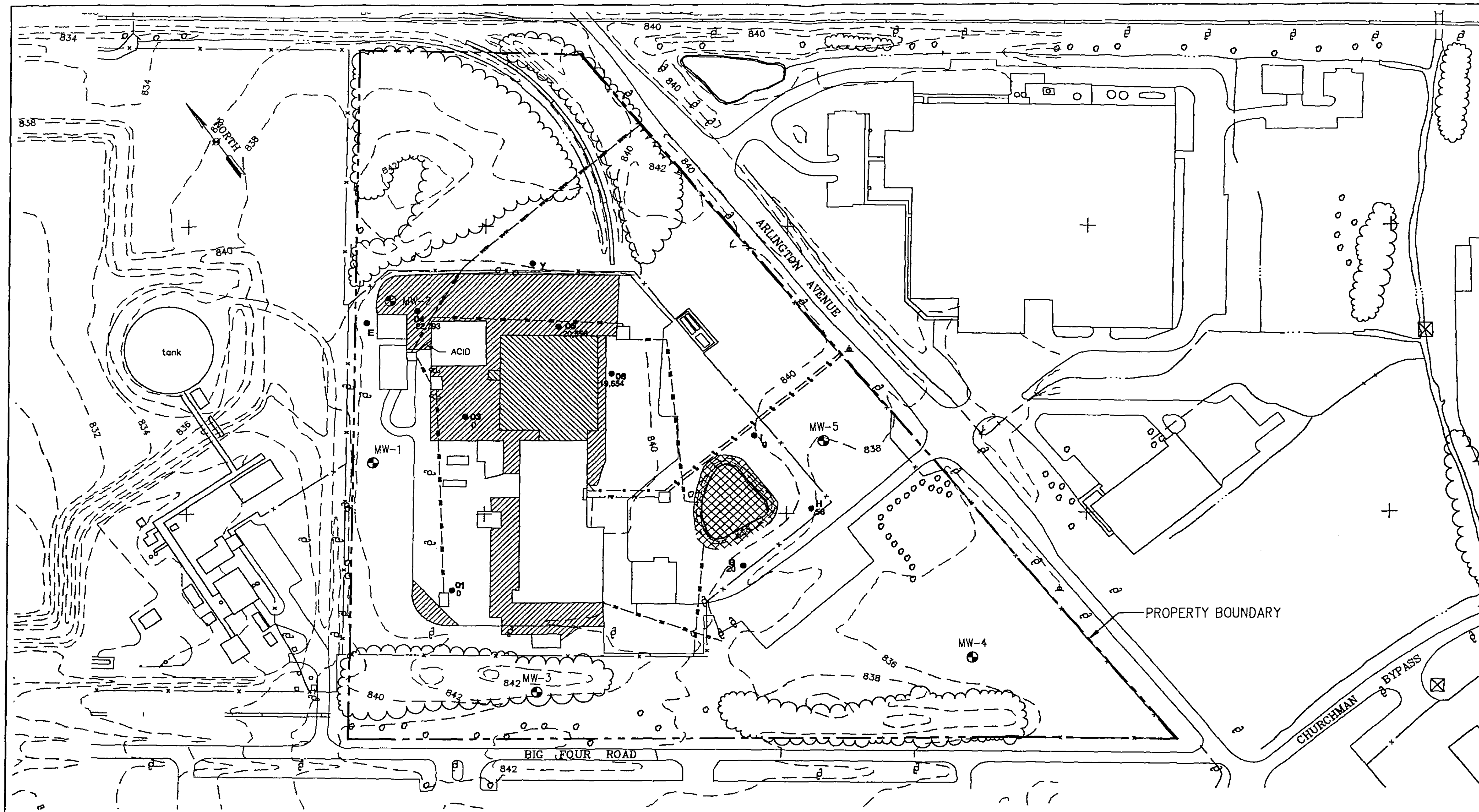
Issued: OCT 1 2 1998

CONCENTRATIONS OF LEAD IN EXTERIOR SURFACE (0-4") SOIL SAMPLES LOCATED NEAR OUTSIDE SWMUs

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-02

FIGURE: 10-4



LEGEND

● A	SAMPLE LOCATION
16,576	XRF RESULT (PPM)
0	NON-DETECTABLE XRF RESULT (PPM)
	OUTDOOR WASTE PILES
	INDOOR WASTE PILES
	LINED SURFACE WATER IMPOUNDMENT
MW-3	GROUNDWATER MONITORING WELLS
	PROPERTY BOUNDARY
	FENCE

180 0 180 360

SCALE IN FEET

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE. SAMPLES WERE COLLECTED AND ANALYZED BY ENTACT, DURING APRIL, 1996

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

Date: 10/12/98
Scale: 1"=180'
Drawn By: P.S.G.
Checked By: S.W.K.
Project Mgr: P.G.S.
Dwg No. 98478-10
Issued: OCT 1 2 1998

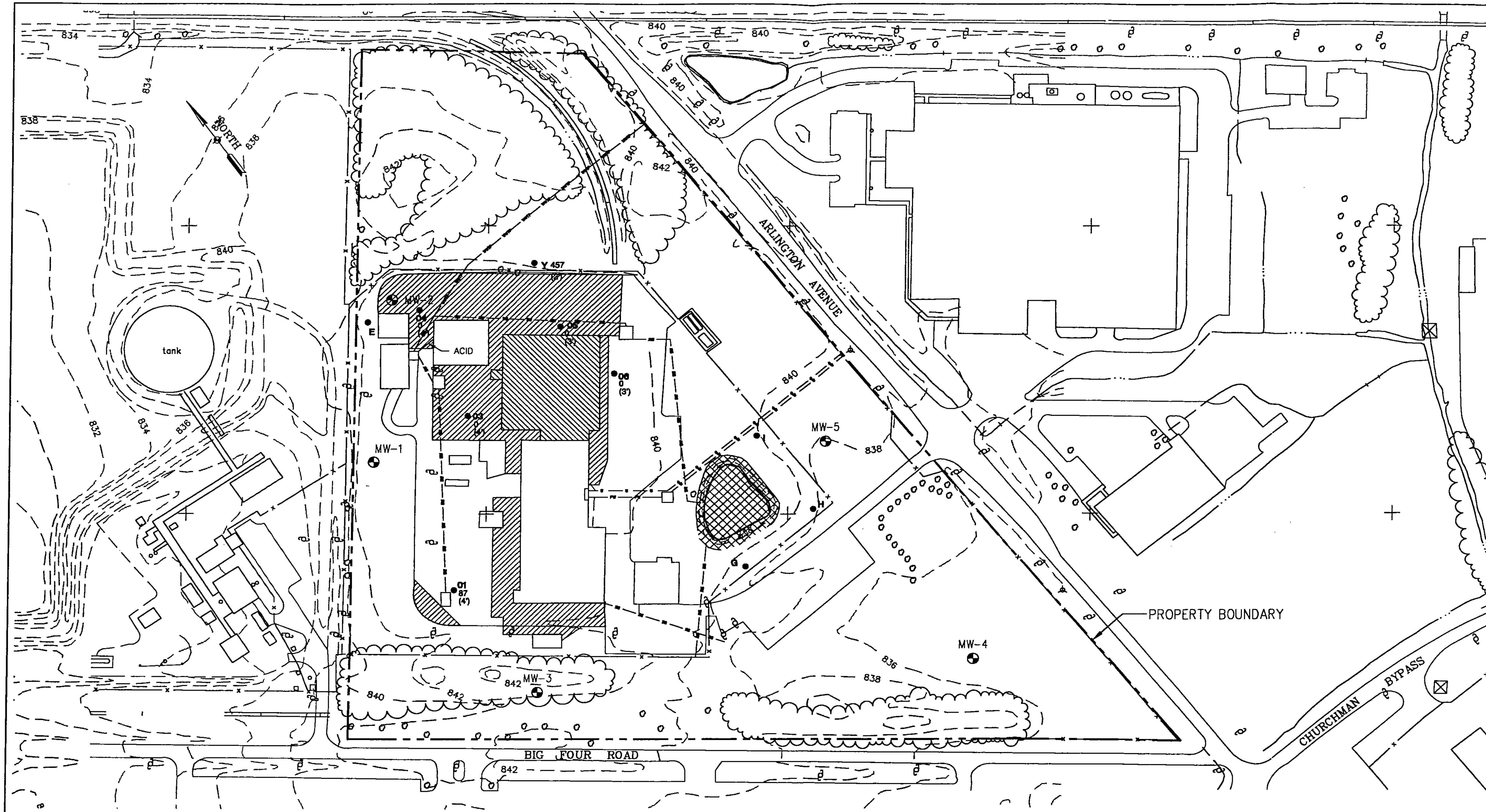
CONCENTRATIONS OF LEAD IN EXTERIOR SURFACE SOIL SAMPLES (4"–12") LOCATED NEAR OUTSIDE SWMUs

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-02

FIGURE: 10-5

J:\REFINED METALS\DRAWINGS\9847802\98478-10



LEGEND

- ● A — SAMPLE LOCATION
- 16,576 — XRF RESULT (PPM)
- 0 — NON-DETECTABLE XRF RESULT (PPM)
- OUTDOOR WASTE PILES
- INDOOR WASTE PILES
- LINED SURFACE WATER IMPOUNDMENT
- MW-3 — GROUNDWATER MONITORING WELLS
- PROPERTY BOUNDARY
- FENCE

180 0 180 360

SCALE IN FEET

NOTE: SAMPLE LOCATIONS ARE APPROXIMATE. SAMPLES WERE COLLECTED AND ANALYZED BY ENTACT, DURING APRIL, 1996

REFINED METALS CORPORATION CLOSURE PLAN

BEECH GROVE, INDIANA

Date: 10/12/98
Scale: 1"=180'
Drawn By: P.S.G.
Checked By: S.W.K.
Project Mgr: P.G.S.
Dwg No. 98478-11
Issued: OCT 12 1998

CONCENTRATIONS OF LEAD IN EXTERIOR SUBSURFACE SOIL SAMPLES (2'-4') LOCATED NEAR OUTSIDE SWMUs

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No. 98-478-02

FIGURE: 10-6

J:\REFINED METALS\DRAWINGS\9847802\98478-11

11.0 PROPOSED SAMPLING AND ANALYSIS PROGRAM

11.1 OUTDOOR WASTE PILES

Soil samples will be collected on the site under the direct supervision of a Professional Geologist (for all sampling) to confirm soil sampling results collected by ENTACT and to more fully determine the extent of site-related constituents in soil. The total area of the outdoor waste piles is approximately 2 acres. The Risk Addendum requires areas being investigated during closure to be subdivided into subareas no greater than 0.5 acres in size to allow comparison to the Tier 1 cleanup goals. Due to the discontinuous and irregular shape of the outdoor waste piles, a total of six subareas (number 1 through 6 on Figure 5-1) were created. A grid was created for each subarea with a grid interval of 10 feet. In accordance with the Risk Addendum, the cube root of the total number of grid nodes was used to calculate the minimum number of random sampling locations for each subarea. A summary of this procedure is provided in Table 11-1. A random numbers table was subsequently used to select the grid nodes to be sampled. Figure 11-1 shows the grid and the 29 proposed soil sample locations.

Samples will be collected initially from every six inches to a depth of one foot and subsequently every one foot to a depth of five feet using a decontaminated hand auger or a geoprobe unit at each location. All samples from 0 to 2 ft. will be analyzed for total lead and cadmium. The samples from 0 to 2 ft. will be homogenized in decontaminated stainless steel bowls prior to being placed in the laboratory-supplied sample jars. Decontamination procedures are described in the QAPP (Appendix C). Since the ENTACT XRF screening results suggest elevated levels of lead in soil are limited in depth, all samples below 2 ft. will be archived and analyzed, as necessary, based on the results of the shallower soil samples.

11.2 INDOOR WASTE PILES (MATERIAL STORAGE BUILDING)

11.2.1 Floor Dust Sampling

Floor dust sampling will be conducted at three locations on the floor within the MSB to confirm

ENTACT's previous sample results and characterize the floor material. Sampling locations will be selected in the field in areas with sufficient dust. Samples will be collected using dedicated disposable scoops. Dust samples will be submitted to the analytical laboratory and analyzed for total lead and cadmium. Additional parameters may also be analyzed to determine the acceptability of the material for resource recovery. The additional parameters and analytical methods will be dictated by the acceptance criteria of the anticipated recycling facility.

11.2.2 Subfloor Soil Sampling

A random grid and directed soil sampling program will be implemented for the indoor waste piles. The random sampling will be performed for the entire unit and directed sampling will be performed at locations where the concrete floor slab appears to have completely deteriorated and potentially created a migration pathway.

The indoor waste piles (i.e., MSB) is approximately 0.7 acres. In accordance withe the Risk Addendum procedures, the unit was subdivided into two subareas, both less than 0.5 acres. The number of required random samples was calculated and are summarized in Table 11-1. A total of 10 random sample locations were determined and are shown on Figure 11-1.

The locations of the directed samples are not shown on Figure 11-1 because the locations of concrete floor areas of interest have not been surveyed . Three locations will be selected in the field by the Principal Investigator for the sampling team.

The floor slabs will be penetrated using a jackhammer or pneumatic drill. Subfloor samples will be collected initially from every six inches to a depth of one foot and subsequently every one foot to a depth of five feet using a geoprobe unit or decontaminated hand auger. Soil samples will be homogenized in decontaminated stainless steel bowls prior to placing them in laboratory-supplied sample jars. Decontamination procedures are described in the QAPP (Appendix C). All samples from 0 to 2 ft. will be analyzed for lead and cadmium. Since the ENTACT XRF screening results suggest elevated levels of lead in soil are limited in depth, all samples below 2 ft. will be archived and analyzed, as necessary, based on the results of the shallower soil samples.

11.3 LINED LAGOON

Previous sampling efforts did not address the lagoon. The lagoon has a known history of receiving potential lead-bearing runoff from the outdoor waste piles and ground surfaces. Therefore, this scope of work will focus on collecting sediment samples from within the lined lagoon. Random grid sampling techniques will also be used to select the sampling locations because no information is available to indicate one area or another which would be more likely to have been impacted. Figure 11-1 shows the proposed sediment sample locations. Samples will not be collected from beneath the lagoon at this time because the lagoon is still actively used.

One composite sediment samples will be collected from four separate locations within the concrete and geomembrane lined surface impoundment. The depth of the sediment will be measured at each sample location; a composite sample will be collected over the vertical profile of sediment at each sample location. Samples will be collected using a decontaminated shovel or disposable scoop so as to not jeopardize the integrity of the liner. Samples will be analyzed for lead and cadmium.

11.4 SUPPLEMENTARY SURVEY

Soil and sediment sample locations will be surveyed by a professional surveyor licensed in the state of Indiana. In addition, the surveyor will perform additional survey tasks. The additional tasks include surveying the monitoring wells, locating utilities, and collecting additional vertical and horizontal data necessary to confirm the accuracy of the base map used for the figures contained in this plan.

11.5 ANALYTICAL REQUIREMENTS

The Quality Assurance Project Plan (QAPP) describes the data collection and management procedures to be followed during the course of this Closure Plan. Procedures to be used during sample collection and custody procedures to be followed through shipment to the laboratory are provided. The data validation and management procedures are also presented. The Quality Assurance Project Plan which was developed as part of the RFI Work Plan, will be used as part of this Closure Plan and is provided in Appendix C. The only significant change made to the QAPP has been Table 3.4 which summarizes the number and type of samples to be collected from each SWMU. Note, some activities in the QAPP are specific to the RFI and are not applicable at this time to the Closure activities, such as groundwater sampling; however, these sections have not been changed or deleted.

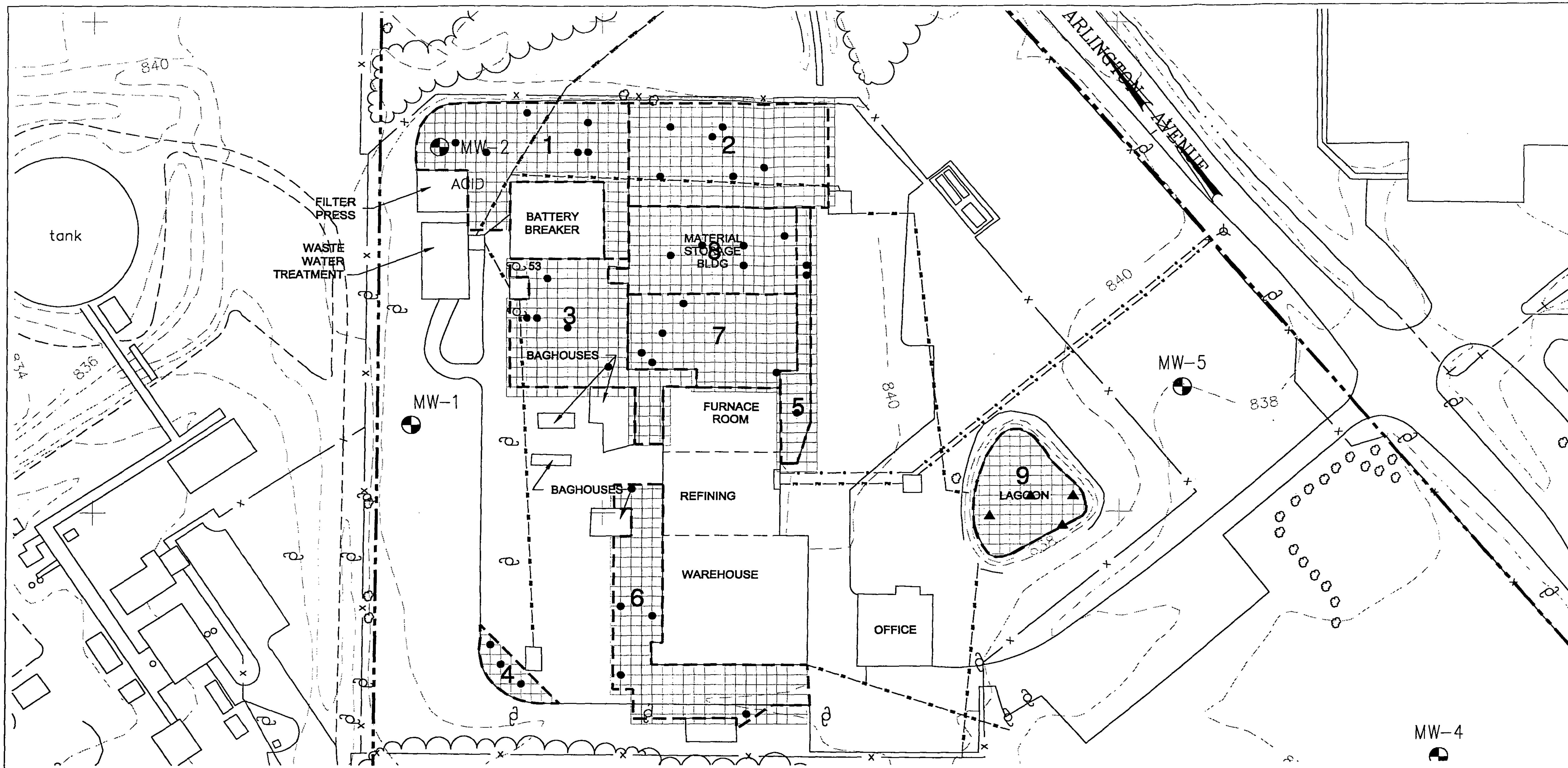
TABLE 11-1

SUMMARY OF RANDOM SAMPLE LOCATION FREQUENCY DETERMINATION

OUTDOOR WASTE PILES SWMU

Sub Area	Area (ft^2)	# Grid Nodes	Cube Root of Grid Nodes	Number of Sample Locations
1	19,460	170	5.5	6
2	20,350	190	5.7	6
3	17,170	146	5.3	5
4	2,410	24	2.9	3
5	4,790	40	3.4	3
6	17,180	143	5.2	5
Indoor Waste Piles SWMU				
7	14,070	128	5.0	5
8	14,600	130	5.1	5
Lagoon SWMU				
9	9,350	92	4.5	4

TOTAL RANDOM SAMPLE LOCATIONS = 42



LEGEND

▲ PROPOSED SEDIMENT SAMPLE LOCATION

● PROPOSED SUBSURFACE SOIL SAMPLE LOCATION

– – – BOUNDARY OF SAMPLING AREA SUBDIVISION WITHIN A SWMU

100 0 100 200

SCALE IN FEET

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

Date: 10/12/98	PROPOSED SAMPLE LOCATIONS FOR SWMU
Scale: 1"=100'	
Drawn By: V.E.N.	
Checked By: S.W.K.	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-14	
Issued: OCT 12 1998	Project No. 98-478-02 — FIGURE: 11-1

J:\REFINED METALS\DRAWINGS\9847802\98478-14

12.0 DESCRIPTION OF SOIL REMEDIATION ACTIVITIES

No soil remediation activities are planned at this time. The need for future soil remediation will be evaluated based on the Closure sampling and analysis program. An addendum to the Closure Plan will be developed and submitted for approval, if necessary, to address soil remediation.

13.0 DISPOSAL UNIT CLOSURES

No unit is currently planned to be closed with waste left in place. An addendum to the Closure Plan will be developed and submitted for approval if this situation changes.

14.0 DESCRIPTION OF EQUIPMENT CLEANING

Equipment used during the sampling and analysis program will be decontaminated in accordance with the QAPP. Specific procedures for decontamination heavy equipment used for decontamination and remedial action activities will be developed as an addendum to the Closure Plan, as necessary, in the future.

15.0 CLOSURE AND POST-CLOSURE ESTIMATES

Closure and Post-Closure Cost Estimates were previously developed by Heritage Environmental Services. The costs estimates are $ 900,000 and $ 0, respectively. A copy of the estimates are provided in Appendix D.

16.0 FINANCIAL ASSURANCE

A copy of the previously submitted financial assurance documental for the Site is provided in Appendix E.

REFERENCES

Indiana Department of Environmental Management, 1997. Hazardous Waste Management Unit Closure Guidance, WASTE-0013-NPD. July.

Indiana Department of Environmental Management, 1997. Risk-Integrated System of Cleanups-Public Draft. October.

Indiana Department of Environmental Management, 1998. Risk Assessment Addendum to the Hazardous Waste Management Unit Closure Guidance. September.

Refined Metals Corporation, Undated. Draft Hazardous Waste Permit Application Part A Permit.

APPENDIX A

DRAFT HAZARDOUS WASTE PERMIT APPLICATION

PART A

Form Approved. OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

For EPA Regional Use Only

Date Received: Month ___ Day ___ Year ___

EPA

United States Environmental Protection Agency
Washington, DC 20460

Hazardous Waste Permit Application Part A

(Read the Instructions before starting)

DRAFT

I. Installation's EPA ID Number (Mark 'X' in the appropriate box)

[ ] A. First Part A Submission

[X] B. Part A Amendment # ______

C. Installation's EPA ID Number	D. Secondary ID Number (If applicable)
IND000718130	NA

II. Name of Facility

REFINED METALS CORPORATION

III. Facility Location (Physical address not P.O. Box or Route Number)

A. Street: 3700 SOUTH ARLINGTON AVENUE

Street (Continued):

City or Town	State	Zip Code
BEECH GROVE	IN	46107–

County Code (If known)	County Name
049	MARION

B. Land Type (Enter Code)	C. Geographic Location: LATITUDE (Degrees, Minutes & Seconds)	LONGITUDE (Degrees, Minutes & Seconds)	D. Facility Existence Date: Month	Day	Year
P	39 42 05	1 086 03 05 6			1968

IV. Facility Mailing Address

Street or P.O. Box: PO BOX 188

City or Town	State	Zip Code
BEECH GROVE	IN	46107 –

V. Facility Contact (Person to be contacted regarding waste activities at facility)

Name (Last)	(First)
FREUDIGER	T. WILLIAM

Job Title	Phone Number (Area Code and Number)
VICE PRESIDENT	901–775–3772

VI. Facility Contact Address (see instructions)

A. Contact Address: Location	Mailing	Other	B. Street or P.O. Box
		X	PO BOX 9009

City or Town	State	Zip Code
MEMPHIS	TN	38109–

DRAFT

Form Approved, OMB No. 2050-0034 Expires [illegible]
GSA No. 0248-EPA-OT

Please print or type with ELITE type (12 characters p[illegible]) in the unshaded areas only

EPA I.D. Number (Enter from page 1): I N D 0 0 0 7 1 8 1 3 0

Secon[illegible]y ID Number (Enter from page 1): N A

VII. Operator Information (See instructions)

Name of Operator: REFINED METALS CORPORATION

Street or P.O. Box: 3700 ARLINGTON AVENUE

City or Town: BEECH GROVE | State: IN | Zip Code: 46107 —

DRAFT

Phone Number (Area Code and Number): 317—787—6364

B. Operator Type: P

C. Change of Operator Indicator: Yes [ ] No [X]

Date Changed: Month Day Year

VIII. Facility Owner (See instructions)

A. Name of Facility's Legal Owner: REFINED METALS CORPORATION

Street or P.O. Box: PO BOX 9009

City or Town: MEMPHIS | State: TN | Zip Code: 38109 —

Phone Number (Area Code and Number): 901—775—3772

B. Owner Type: P

C. Change of Owner Indicator: Yes [ ] No [X]

Date Changed: Month Day Year

IX. SIC Codes (4-digit, in order of significance)

Primary	Secondary
3341 Secondary Lead Smelting & Refining	
Secondary	**Secondary**

X. Other Environmental Permits (See instructions)

A. Permit Type (Enter code)	B. Permit Number	C. Description
E	334103	POTW DISCHARGE PERMIT
E	0036	AIR POLLUTION CONTROL SECTION

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GSA No. 0248-EPA-OT

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

EPA I.D. Number (Enter from page 1)

I	N	D	0	0	0	7	1	8	1	3	0

Secondary ID Number (Enter from page 1)

N	A									

XI. Nature of Business (Provide a brief description)

SIC Code 3341 - Lead-Acid battery reclamation/secondary smelting of lead-bearing scrap and residues.

DRAFT

XII. Process Codes and Design Capacities

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Thirteen lines are provided for entering codes. If more lines are needed, attach a separate sheet of paper with the additional information. For "other" processes (i.e., D99, S99, T04 and X99), describe the process (including its design capacity) in the space provided in item XIII.

B. PROCESS DESIGN CAPACITY - For each code entered in column A, enter the capacity of the process.

1. AMOUNT - Enter the amount. In a case where design capacity is not applicable (such as in a closure/post-closure or enforcement action) enter the total amount of waste for that process.
2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

C. PROCESS TOTAL NUMBER OF UNITS - Enter the total number of units used with the corresponding process code.

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
	Disposal:	
D79	Underground Injection	Gallons; Liters; Gallons Per Day; or Liters Per Day
D80	Landfill	Acre-feet or Hectare-meter
D81	Land Treatment	Acres or Hectares
D82	Ocean Disposal	Gallons Per Day r Liters Per Day
D83	Surface Impoundment	Gallons or Liters
D99	Other Disposal	Any Unit of Measure Listed Below
	Storage:	
S01	Container (Barrel, Drum, Etc.)	Gallons or Liters
S02	Tank	Gallons or Liters
S03	Waste Pile	Cubic Yards or Cubic Meters
S04	Surface Impoundment	Gallons or Liters
S05	Drip Pad	Gallons or Liters
S06	Containment Building-Storage	Cubic Yards or Cubic Meters
S99	Other Storage	Any Unit of Measure Listed Below
	Treatment:	
T01	Tank	Gallons Per Day or Liters Per Day
T02	Surface Impoundment	Gallons Per Day or Liters Per Day
	Incinerator	Short Tons Per Hour; Metric Tons Per Hour; Gallons Per Hour; Liters Per hour; or BTUs Per Hour
T04	Other Treatment	Gallons Per Day or Liters Per Day Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or BTUs Per Hour
T80	Boiler	Gallons or Liters
T81	Cement Kiln	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or BTUs Per Hour
T82	Lime Kiln	
T83	Aggregate Kiln	
T84	Phosphate Kiln	
T85	Coke Oven	
T86	Blast Furnace	

PROCESS CODE	PROCESS	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
T87	Smelting, Melting or Refining Furnace	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or BTUs Per Hour
T88	Titanium Dioxide Chloride Process Oxidation Reactor	
T89	Methane Reforming Furnace	
T90	Pulping Liquor Recovery Furnace	
T91	Combustion Device Used in the Recovery of Sulfur Values from Spent Sulfuric Acid	
T92	Halogen Acid Furnaces	
T93	Other Industrial Furnaces Listed in 40 CFR §260.10	
T94	Containment Building-Treatment	Cubic Yards or Cubic Meters
	Miscellaneous (Subpart X):	
X01	Open Burning/Open Detonation	Any Unit of Measure Listed Below
X02	Mechanical Processing	Short Tons Per Hour; Metric Tons Per Hour; Short Tons Per Day; Metric Tons Per Day; Pounds Per Hour; or Kilograms Per Hour
X03	Thermal Unit	Gallons Per Day; Liters Per Day; Pounds Per Hour; Short Tons Per Hour; Kilograms Per Hour; Metric Tons Per Day; Metric Tons Per Hour; Short Tons Per Day; or BTUs per Hour
X04	Geologic Repository	Cubic Yards or Cubic Meters
X99	Other Subpart X	Any Unit of Measure Listed Below

UNIT OF MEASURE	UNIT OF MEASURE CODE
Gallons	G
Gallons Per Hour	E
Gallons Per Day	U
Liters	L
Liters Per Hour	H
Liters Per Day	V

UNIT OF MEASURE	UNIT OF MEASURE CODE
Short Tons Per Hour	D
Metric Tons Per Hour	W
Short Tons Per Day	N
Metric Tons Per Day	S
Pounds Per Hour	J
Kilograms Per Hour	R

UNIT OF MEASURE	UNIT OF MEASURE CODE
Cubic Yards	Y
Cubic Meters	C
Acres	B
Acre-feet	A
Hectares	Q
Hectare-meter	F
Btu's Per Hour	I

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Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

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EPA I.D. Number (*Enter from page 1*): I N D 0 0 0 7 1 8 1 3 0

Secondary ID Number (*Enter from page 1*): N A

XII. Process Codes and Design Capabilities (*Continued*)

EXAMPLE FOR COMPLETING ITEM XII (Shown in line number X-1 below): A facility has a storage tank, which can hold 533,788 gallons.

Line Number	A. Process Code (From list above)	B. Process Design Capacity: 1. Amount (Specify)	B. Process Design Capacity: 2. Unit of Measure (Enter Code)	C. Process Total Number of Units	For Official Use Only
X 1	S 0 2	533.788	G	001	
1	S 0 1	1,207.592	G	003	
2	S 0 6	4.600	Y	002	
3	S 0 4	600.000	G	001	
4	S 0 3	15.000	Y	009	
5		.			
6		.			
7		.			
8		.			
9		.			
1 0		.			
1 1		.			
1 2		.			
1 3		.			

NOTE: If you need to list more than 13 process codes, attach an additinoal sheet(s) with the infomration in the same format as above. Number the lines sequentially, taking into account any lines that will be used for "other" processes (i.e., D99, S99, T04, and X99) in Item XIII.

XIII. Other Processes (*Follow instructions from item XII for D99, S99, T04 and X99 process codes*)

Line Number	A. Process Code (From list above)	B. Process Design Capacity: 1. Amount (Specify)	B. Process Design Capacity: 2. Unit of Measure (Enter Code)	C. Process Total Number of Units	D. Description of Processes
X 1	T 0 4				In-situ Vitrification
1		.			
2		.			
3		.			
4		.			

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EPA I.D. Number (Enter from page 1): I N D 0 0 0 7 1 8 1 3 0

Secondary ID Number (Enter from page 1): N A

XIV. Description of Hazardous Wastes (Continued)

Line Number	A. EPA Hazardous Waste No. (Enter Code)	B. Estimated Annual Quantity of Waste	C. Unit of Measure (Enter Code)	D. Processes (1) Process Codes (Enter code)	D. Processes (2) Process Description (If a code is not entered in D(1))
1	D008	50,000	T	S01 S06 S03	S04
2	D002	1,700,000	G	S01 S06 S03	
3	K069	5,000	T	S01 S06 S03	
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
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32					
33					

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Form Approved, OMB No. 2050-0034 Expires 9-30-96
GSA No. 0248-EPA-OT

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

EPA I.D. Number (Enter from page 1)												Secondary ID Number (Enter from page 1)	
I	N	D	0	0	0	7	1	8	1	3	0	N	A

XV. Map

Attach to this application a topographic map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in this map area. See instructions for precise requirements.

XVI. Facility Drawing

All existing facilities must include a scale drawing of the facility (see instructions for more detail).

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XVII. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

XVIII. Certification(s)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Owner Signature	Date Signed
Name and Official Title (Type or print)	
Owner Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature	Date Signed
Name and Official Title (Type or print)	
Operator Signature	Date Signed
Name and Official Title (Type or print)	

XIX. Comments

[1] S03 Units are designated as separate units for administrative purposes in the Part A Hazardous Waste Permit Application.

Note: Mail completed form to the appropriate EPA Regional or State Office. (Refer to instructions for more information)

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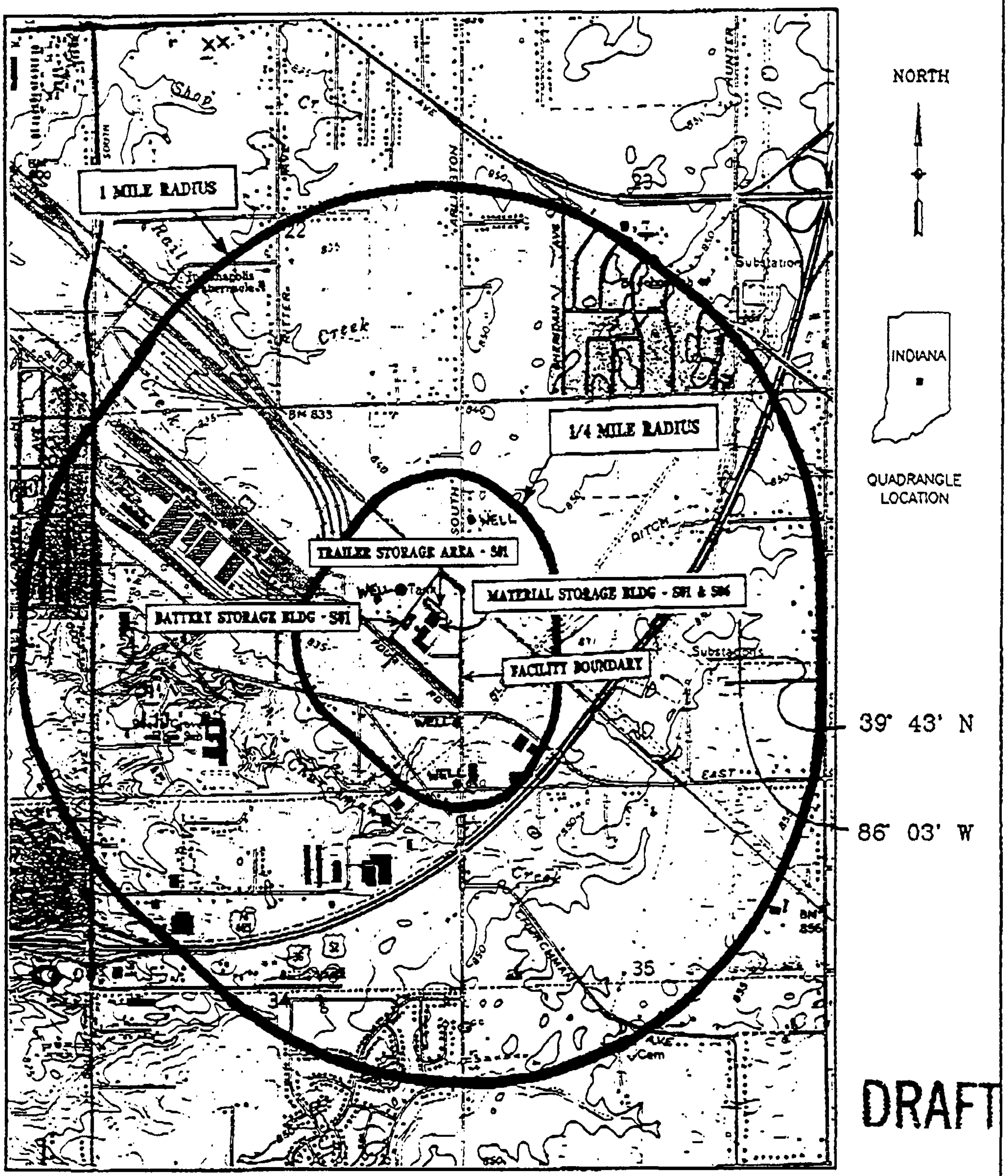
TOPOGRAPHIC MAP

DRAFT



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NOTES:

1. NO INJECTION WELLS ARE LOCATED AT THE FACILITY.

REF: USGS 7.5 MINUTE SERIES
INDIANA – BEECH GROVE QUADRANGLE

SCALE: 1" = 2000'

0 1000 2000

REFINED METALS CORPORATION

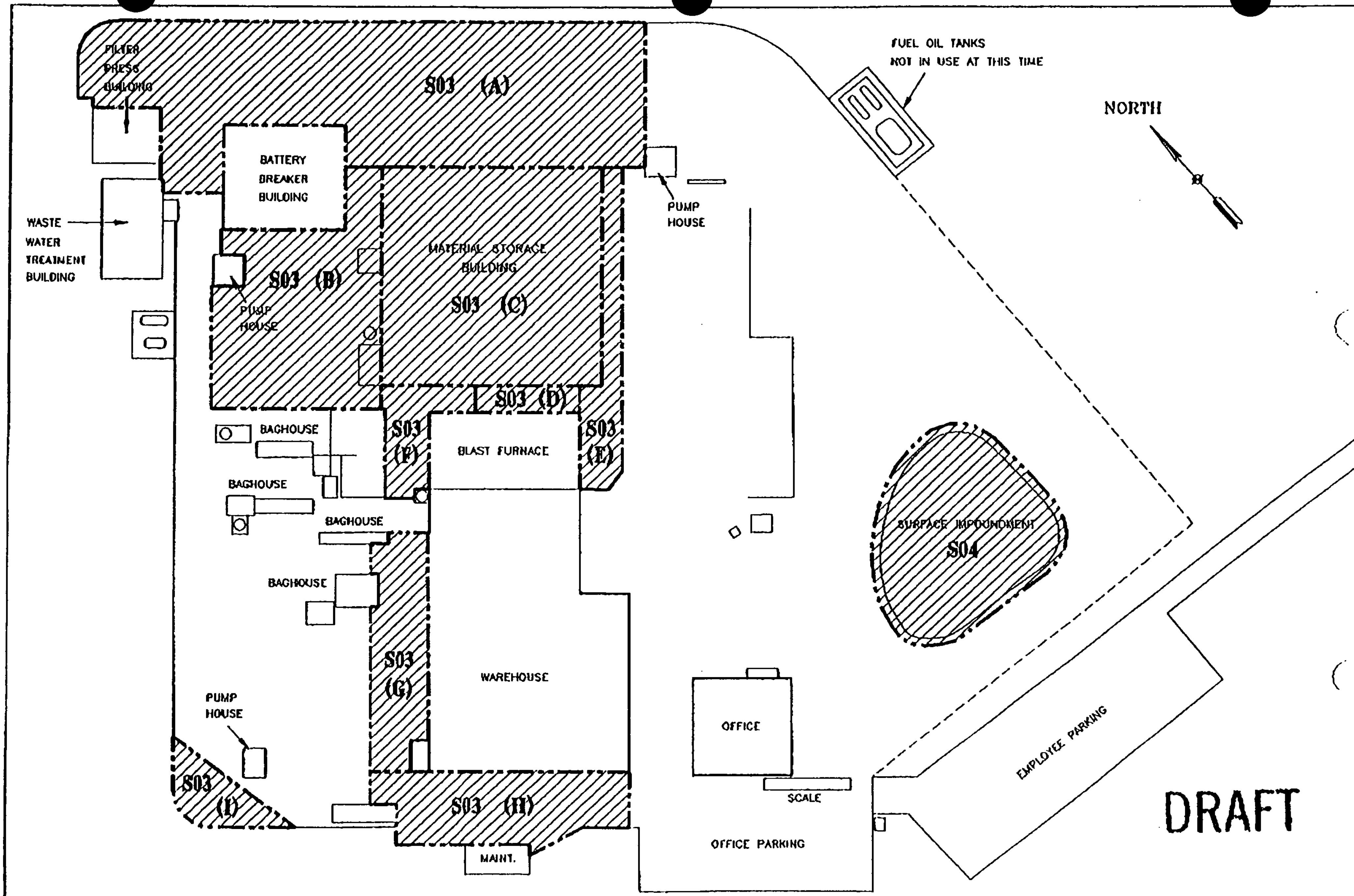
TOPOGRAPHIC MAP
1 MILE RADIUS OF FACILITY

DRAWN BY: JFH	HERITAGE	DATE: 8-25-94
APP. BY: AF		SCALE: 1" = 2000'
JOB NO. 25190		DWG. 25190V03

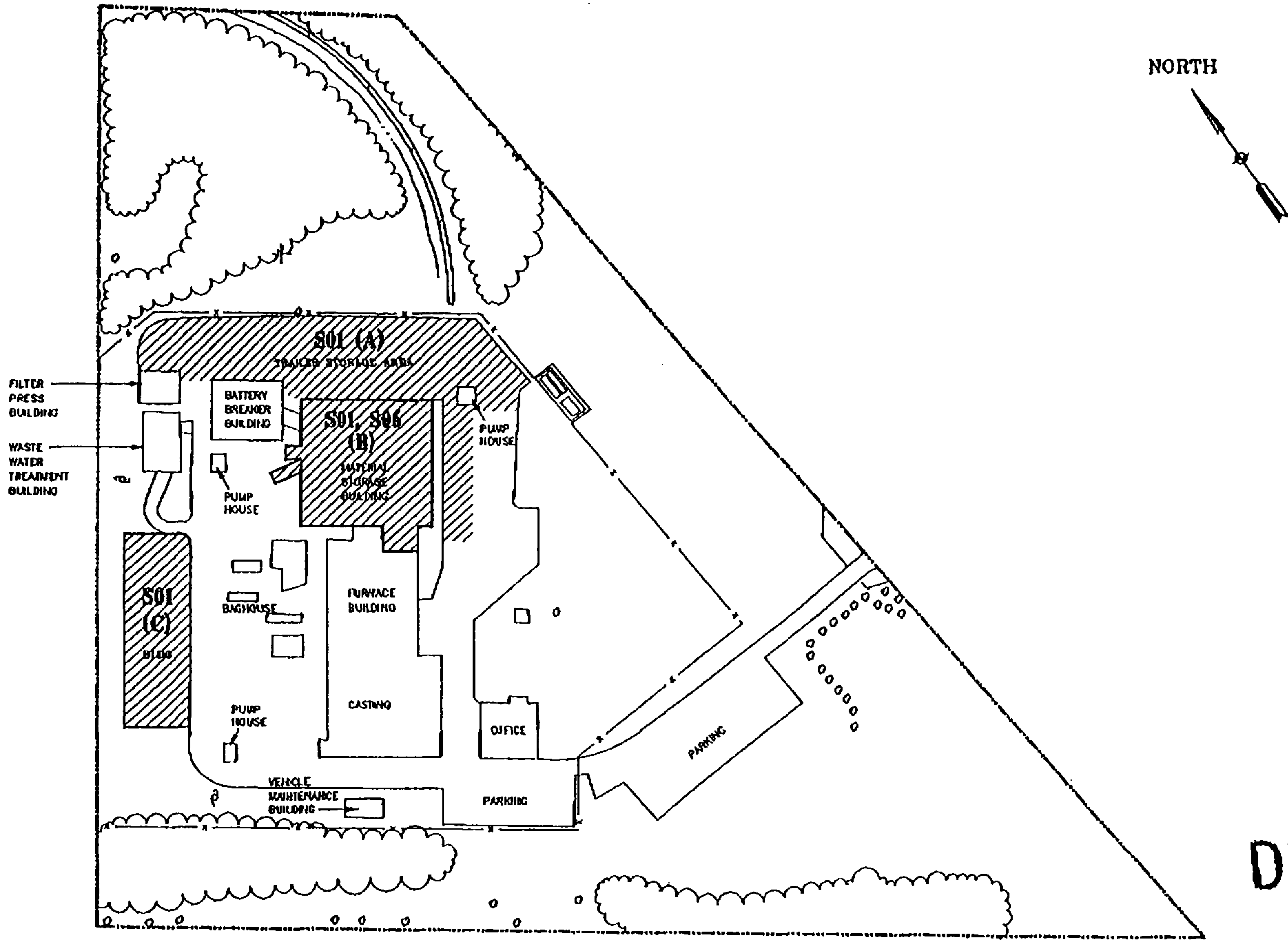
HERITAGE ENVIRONMENTAL SERVICES, INC.

SCALE DRAWINGS
EXISTING REGULATED UNITS
AND UNITS BEING PERMITTED

DRAFT



HERITAGE	EXTRACED FROM: **EXHIBIT B**	SCALE: 1" = 100' (0, 1/2", 1"; 0, 50', 100')	DRAWN BY: JFH · DATE: 2-14-95 · PROJ. NO. 28190 · APP. BY: RB · SCALE: 1" = 100' · DWG. NO. 28190X67 · HERITAGE ENVIRONMENTAL SERVICES, INC. INDIANAPOLIS, INDIANA	REFINED METALS CORPORATION BEECH GROVE, INDIANA · EXISTING SITE PLAN



DRAFT

HERITAGE	SCALE 1" = 200' (0, 1/2", 1"; 0, 100', 200')	DRAWN BY: JFK / APP. BY: RB	DATE: 2-14-95 / SCALE: 1" = 200'	PROJ. NO. 28190 / DWG. NO. 28190X68

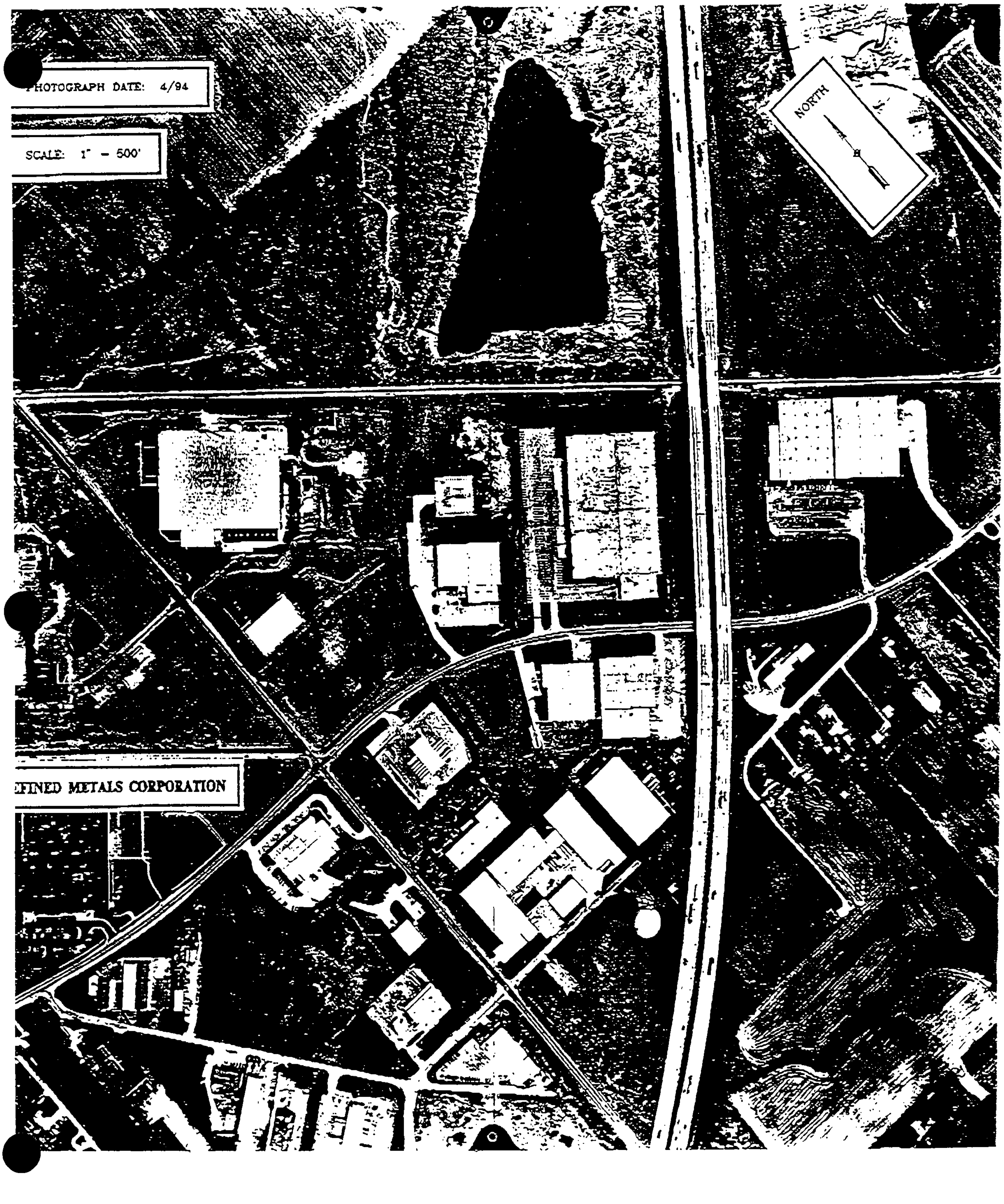
HERITAGE ENVIRONMENTAL SERVICES, INC.
INDIANAPOLIS, INDIANA

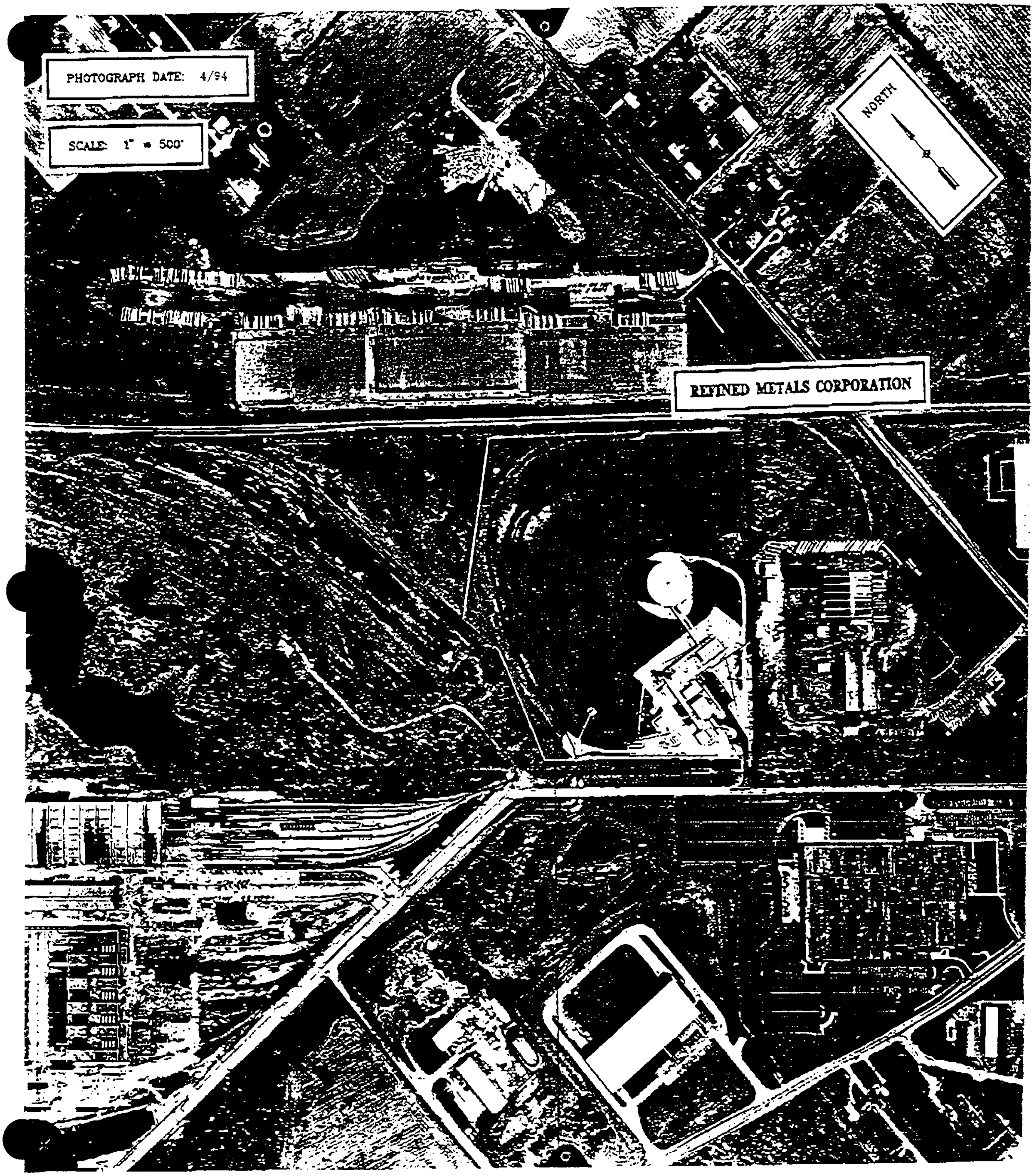
REFINED METALS CORPORATION
BEECH GROVE, INDIANA

FUTURE SITE PLAN

PHOTOGRAPHS

DRAFT


PHOTOGRAPH DATE: 4/94
SCALE: 1" = 500'
NORTH
EFINED METALS CORPORATION


PHOTOGRAPH DATE: 4/94
SCALE: 1" = 500'
NORTH
REFINED METALS CORPORATION

LEGAL DESCRIPTION

DRAFT

LEGAL DESCRIPTION

Part of the Northeast Quarter and part of the Southeast Quarter of Section 27, Township 15 North Range 4 East, Marion County, Indiana, being more particularly described as follows:

Commencing at the Southeast corner of said Northeast Quarter; thence North 0° 04'06" West, on and along the East line of said Northeast Quarter, 27.83 feet measured (27.6 feet deed) to the Southwesterly line of the original 80 foot right of way line of the C. C. C. St. L. R. R.; thence North 49° 57'00" West on and along said right of way line, 19.61 feet measured (19.60 feet deed) to the point of beginning of this description; thence South 0° 04'08" East, parallel to and 15.00 feet from said East line, 40.45 feet, thence South 0° 00'00" West, parallel to and 15.00 feet from the East line of said Southeast Quarter, 1527.23 feet to the Northeasterly line of Big Four Road; thence North 49° 57'00" West, on and along said Northeasterly line, 1150.00 feet thence North 40° 08'00" East 80.00 feet, thence North 49° 57'00" West, parallel to said Northeasterly line, 280.24 feet; thence North 40° 02'50" East measured (North 40° 03' East deed) 1120.00 feet to said Southwesterly rail road right of way line; thence South 49° 57'00" East, on and along said right of way line, 421.53 feet to the point of beginning.

DRAFT

The parties determined that the facility could meet the LDRs exemption criteria provided it installs steel plates underneath the discarded slag storage area and elevates the walls surrounding that area. EPA requested that Refined Metals Corporation confirm, in writing, its commitment to upgrade the discarded slag storage area in conformance with the February 9 discussions. This letter will serve as that confirmation.

Specifically, Refined Metals Corporation will only store discarded slag in the area designated "2" in the attached diagram. Furthermore, no discarded slag will be stored for more than 90 days. This area, which is approximately 56′ by 27′, will be underlined with steel plates. The facility is currently investigating the thickness of the steel plates; a minimum of 3/8" will be required. A new wall will be installed to segregate this area; the approximate configuration of the wall will be 56′ x 8′ x 8". Further, the existing exterior wall will be elevated. Consequently, the area will be surrounded, on three sides, by 8′ concrete walls.

Refined Metals Corporation requests that the regulatory agencies review this proposal and provide written approval before the Company undertakes the necessary modifications.

On behalf of Refined Metals Corporation, we appreciate your attention to this request. Under separate cover, I will provide you with the revised language in connection with the Consent Decree.

Sincerely,

Robert N. Steinwurtzel

Enclosures

cc: Brian Barwick
Leslie Williams
Bill Freudiger
Mike Meloy
Craig Hogarth

APPENDIX B

HEALTH AND SAFETY PLAN

REFINED METALS CORPORATION SITE

Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

October 12, 1998
98-478-02

F:\OFICEAGC\PROJECTS\FILES\98-478\Reports\H&SPlan.wpd

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C Medical Monitoring
D Personnel Protective Equipment
E Decontamination
F Temperature Extreme Guidelines

1.0 INTRODUCTION

This Health and Safety Plan (HSP) has been developed to reflect current health and safety procedures with regard to performing Closure Facility Investigation (Closure) field activities at the Refined Metals Corporation (Site) located in Beech Grove, Marion County, Indiana. The closure field activities at the Site will be conducted in accordance with the Closure Work Plan, developed by Advanced GeoServices Corp. (AGC). Presented herein are the minimum required health and safety procedures for Advanced GeoServices Corp., contractors, and subcontractors participating in the closure field activities.

The procedures set forth in this HSP are designed to reduce the risk of exposure to chemical substances that may be present in the soil, water, and air and other hazards associated with closure field activities. The procedures set forth herein are developed in accordance with the provisions of 29 CFR 1910.120 (Hazardous Waste Operations and Emergency Response). The recommended health and safety guidelines set forth within this document may be modified as further information is made available through sample analysis and on-site characterization.

Site specific information is presented in Sections 1 through 14 of this HSP, with general health and safety information located in Appendix A through F of this document.

1.1 APPLICABILITY

The provisions of the HSP are mandatory for all on-site AGC employees, contractors, and subcontractors engaged in closure field operations who may be exposed or have the potential to be exposed to hazardous substances at the referenced site.

This HSP provides the minimum requirements for contractors and subcontractors health and safety protection for field activities in support of the designated proposed field activities. Contractors and/or subcontractors may choose to use this HSP as a guide in developing their own plan (which shall be reviewed and approved by AGC), or may choose to adopt and comply in full with this HSP when performing the designated field activities at the Site. If the contractor and/or subcontractor adopts this HSP, all personnel assigned to site field activities for the project must read and sign the Plan Acceptance Form and complete a Health and Safety Compliance Certification Form (Appendix A) before commencing site activities. In either case, contractors and/or subcontractors will hold AGC harmless from, and indemnify it against, all liability in the case of any injury. AGC reserves the right to review and revise the HSP at any time. At a minimum, all provisions of this HSP will be followed.

Inadequate health and safety precautions on the part of the contractor and/or subcontractor, or the belief that the contractor's and/or subcontractor's personnel are or may be exposed to an immediate health hazard, can cause AGC to suspend the site work and ask the contractor and/or subcontractor to evacuate the hazard area.

1.2 KEY REGULATIONS

Key regulations that are or may be applicable to the proposed field activities are listed below. Field activities and operations associated with this project (if applicable) will be conducted in accordance with these regulations.

Government Regulations	Subject
29 CFR 1904	Recording and Reporting Occupational Injuries and Illness
29 CFR 1910.120	Hazardous Waste Site Operations
29 CFR 1910.20	Record Keeping/Recording
29 CFR 1910.1000	OSHA Permissible Exposure Limits
29 CFR 1926	Construction Activities
29 CFR 1910.134	Respirator Protection

1.3 SITE LOCATION

The Refined Metals Corporation Site encompasses approximately 24 acres and is located in central Indiana, Marion County. The Site is located at 3700 Arlington Avenue, Beech Grove, Indiana, and is bordered by industrial and commercial facilities, and also vacant lots.

1.4 SITE HISTORY

Refined Metals Corporation was engaged in recycling lead batteries and other lead wastes. There are currently no manufacturing operations at the facility. The plant was constructed in 1968 as a secondary lead smelter. In 1984, a battery breaker operation was installed. From April 14, 1995, through December 31, 1995, operations were reduced to enriching and casting lead ingots from off-specification lead products. Since 1996, no production has taken place and the facility has been inactive.

The facility was constructed to recycle lead batteries and other lead wastes. Auto batteries constituted 90 percent of the materials recycled, and the remainder was waste material from battery manufacturers and other lead scrap. During operation, the batteries were temporarily stored in trailers or on pallets in a paved storage yard. The batteries were then fed into the battery crusher, where the tops of the batteries were sawed off and the sulfuric acid was drained into a stainless steel tank that drained to the wastewater treatment system. The battery casings and their contents were tumbled and crushed. Lead plates and other lead parts were separated and transported to the materials storage building to be later fed into the furnace. The battery casings were shredded and separated into plastic and rubber in a flotation tank. The plastic was blown into a trailer for sale to be sold to an offsite recycler. Rubber was stored and then fed into the blast furnace.

Before 1984, materials were stored on-site with minimal spill or runoff control. Storm water runoff from the storage piles and work areas flowed to the storage pond and evaporated; some runoff flowed off site to the north drainage ditch. The pond appears to have been included on the Part A permit after 1991. Once the battery crusher was installed in 1984, a batch neutralization system was installed to treat wastewater from the battery crushing and flotation systems containing sulfuric acid. The wastewater was neutralized before discharging to Beech Grove Municipal Sanitary Sewer system. Since 1988, all stormwater was contained and routed to the wastewater treatment system. The facility system included:

1. Collection of site runoff water in three 10,000-gallon stainless steel tanks set into concrete sumps with one-foot thick walls and bottoms. PVC pipes conveyed the water from the pump stations to the sumps. The tanks were cleaned annually and inspected for flaws.

2. Collection of sulfuric acid and flotation water in a 6,000-gallon stainless steel-lined sump in the battery breaker building.

3. Storage in two fiberglass tanks.

4. Neutralization with magnesium hydroxide and sodium hydroxide.

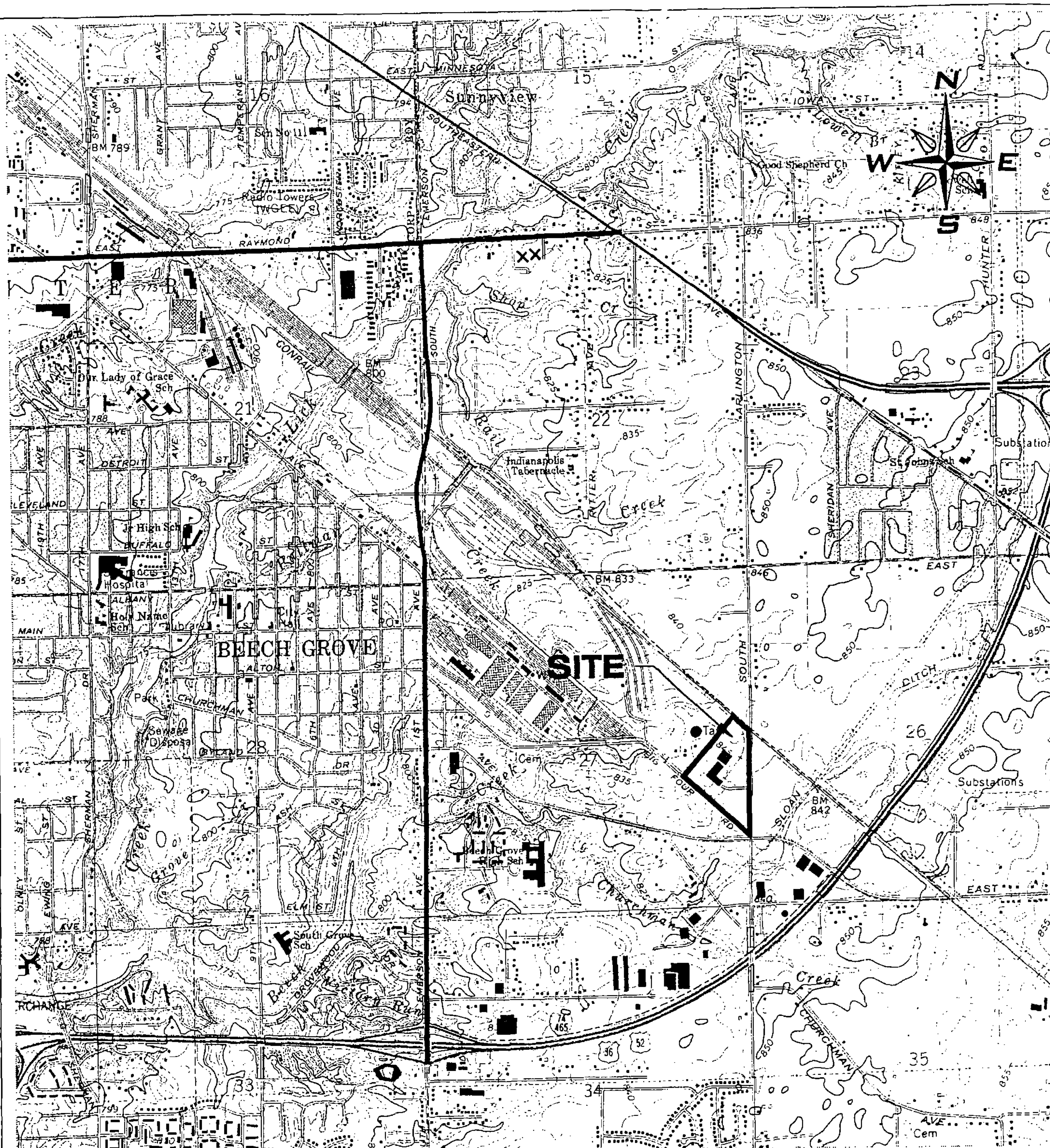
5. Chelation and coagulation of the solid particles with polymers into a settleable floc using polymers.

6. Separation of the water from the floc in a slant-plate clarifier.

7. Concentration of the solids in a filter press.

Reportedly, underground storage tanks (USTs) were never used at the Site. Three above ground storage tanks (ASTs) - two 10,000-gallon (ASTs) and one 20,000-gallon AST - were used to store diesel fuel for company trucks. The tanks were reportedly cleaned out in 1985 and subsequently taken out of service. The three tanks are enclosed by a spill containment wall which was reportedly constructed before 1980. A 500-gallon AST and a 750-gallon AST are used for diesel fuel and gasoline, respectively, to fuel on-site vehicles. The 750-gallon gasoline tank is enclosed within a spill containment wall and pad. Propane, which is used to power forklifts, is stored in a 2,000-gallon tank.

A leak in a valve of one of the out-of-service diesel tanks occurred around 1983, resulting in a spill outside of the containment wall. A portion of the spill flowed along the drainage ditch located north of the refining area. The contaminated soil was excavated and the tanks were emptied. Although documentation of the spill is not available, the soil cleanup was reportedly conducted under state supervision.



REF. U.S.G.S. 7 1/2 MINUTE
BEECH GROVE, IND
QUADRANGLE MAP

REFINED METALS CORPORATION
CLOSURE PLAN
BEECH GROVE, INDIANA

Date: 8/27/98	SITE LOCATION MAP
Scale: N.T.S.	
Drawn By: P.S.G.	
Checked By: S.W.K.	Advanced GeoServices Corp Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-01	Project No. 98-478-02
Issued:	FIGURE: 1-1

J:\REFINED METALS\DRAWINGS\9847802\98478-01

2.0 SUMMARY OF POTENTIAL CLOSURE FIELD ACTIVITIES

	TASK	DESCRIPTION
A.	Soil Sampling	Collect soil samples.
B.	Sediment Sampling	Collect sediment samples from stormwater impoundment and former drainage channels.
C.	Groundwater Sampling	Collect groundwater samples.
D.	Site Survey	Survey wells for horizontal and vertical control.
E.	Site Walk	Tour site.

Refer to the Closure Work Plan for a detailed description of the scope of work for the closure field activities.

3.0 PROJECT PERSONNEL RESPONSIBILITIES

The following responsibilities and authorities have been or will be assigned to designated personnel for closure field activities.

AGC Project Manager

Mr. Paul G. Stratman, P.E. will be the AGC Project Manager for the project. The AGC Project Manager will serve in a supervisory capacity over all activities and personnel involved in conducting field activities in support of the Closure Work Plan during this project.

AGC CLOSURE Task Manager

The Closure Task Manager will serve in a supervisory capacity over the activities conducted during the field activities at the RMC. The AGC Closure Task Manager will be responsible for assuring that the HSP is adhered to and that procedures outlined in the plan will be carried out during the field activities. Mr. Stephen Kirschner, P.E. will serve as the AGC Closure Task Manager for this project.

AGC Site Health and Safety Officer

A Site Health and Safety Officer will be designated by the AGC Project Manager for specific site activities to ensure that required monitoring will be conducted during the investigation, and to ensure that the HSP is properly implemented. The Site Health and Safety Officer will be responsible for:

- the field implementation, evaluation, and any necessary field modification of this HSP;
- notification of off-site emergency response personnel and other potentially affected parties, as necessary;
- notification of the EPA Project Coordinator, Section Chief, or Eastern Response Section Hotline;
- notification of IDEM office;

- maintaining adequate supplies of all personal protective equipment as well as calibration and maintenance of selected monitoring instruments; and

- suspending activities at the site which are not in conformance to the HSP.

The Site Health and Safety Officer will be designated by the AGC Project Manager for those activities involving AGC personnel. The Site Health and Safety Officer will be a qualified employee of AGC or their designee. The designation of the Site Health and Safety Officer may be changed by the AGC Project Manager, depending on site activities or conditions, as appropriate.

4.0 SITE CHARACTERIZATION

4.1 SITE ACCESS

The RMC site is defined in the Consent Decree (3700 Arlington Rd., Beech Grove, Indiana, 46107) as where contamination related to the Site is detected, or where activities are required for the Closure. Access to specific task work at the Site will be through access areas specified by AGC personnel. As such, site access will be controlled at the specific task work locations where Closure activities are planned.

The specific task work areas will be divided into temporary work zones as a means to control task area access and decontamination efforts, where necessary. The work areas may include the following zones (while site work is occurring) to control access:

- Support Zone - Clean area, storage for excess non-contaminated equipment;
- Contaminant Reduction Zone (CRZ) - where decontamination processes will take place. Location of the decontamination pad and containers of contaminated personal protective equipment (PPE);
- Exclusion Zone - Potentially contaminated area.

Access to the task work areas during the Closure field activities will be limited to authorized personnel. The exclusion zone will be cordoned off, if deemed necessary by the Health and Safety Officer, by barricade tape or some other equipment method which will designate the exclusion zone boundary. The zones will also be monitored by the Site Safety Officer or his designee to insure personnel do not enter without proper training and protection.

In the event of an emergency or release, site egress away from a work area will be by the nearest route in the upwind and upslope directions, as appropriate.

4.2 SITE CONTROL

Certain procedures will be followed to insure suitable task work area control and limit access so that those persons who may be unaware of the work area condition are not exposed to inherent hazards. Potentially contaminated media, such as purged groundwater, will be placed in approved containers and secured in an area on the RMC property to prevent unauthorized tampering. A log of AGC, RMC, EPA, IDEM and other personnel related to the Closure investigation activities will be maintained in the bound field logbook by AGC site personnel.

5.0 PERSONNEL TRAINING

General site workers (such as equipment operators, general laborers, and supervisory personnel) engaged in hazardous substance activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of class room instruction, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor. Exemptions to these requirements, e.g., decreasing the number of training hours to 24, are found in Appendix B of this HSP. Health and safety training programs shall comply with the criteria set forth by Occupational Safety and Health Administration (OSHA) as per final Regulation 29 CFR 1910.120. Exceptions from training are subject to review by the Site Health and Safety Officer and/or the Closure Task Manager. Documentation of personnel meeting the required training will be maintained at AGC's office.

This HSP will be distributed to all project personnel for review prior to the start of field activities. A pre-operation meeting for each task will be held by the Health and Safety Officer to discuss the contents of the HSP. Specialty training will be provided as determined based on task and responsibility.

A more detailed discussion of training requirements is included in Appendix B.

6.0 MEDICAL MONITORING

Personnel involved in field activities associated with this project will be active participants in a medical monitoring program. AGC has implemented a medical monitoring program that complies with the requirements of 29 CFR 1910.120. Documentation of the medical monitoring program for each individual is maintained at AGC's office.

Contractors and subcontractors will be required to adhere to the medical monitoring requirements of CFR 1910.120 and provide documentation of compliance through the use of the Health and Safety Compliance Certification Form (Appendix A-2 of this HSP) or through other appropriate means, or demonstrate exemptions from these requirements based on scheduled activities and work area characterization. An example of such an exemption would be a delivery driver who makes a delivery to the site in an area which has been characterized as having no contamination or no significant potential for exposure to constituents. Appendix C provides general information on medical monitoring.

7.0 HAZARD EVALUATION

The following tables have been prepared that list the potential constituents, constituent properties, and potential health and safety hazards associated with the RMC Site.

Table 7-1	Lists the potential chemical compounds which may be associated with the Site. This table provides a summary of toxicological data for the compounds listed. The most significant compounds listed in Table 7-1 that may be associated with Site according to the Consent Decree and based on toxicity, reported results and likelihood of exposure due to scheduled field tasks are presented in the following section. These compounds have been used as the framework for the action levels discussed in Section 9.0 of this HSP.
Table 7-2	Lists potential health and safety hazards associated with the Site.

Table 7-1

Potential Contaminants of Concern

Contaminant	PEL	STEL	Characteristics	Route of Exposure	Symptoms of Acute Exposure	Target Organs
Cadmium	0.005 mg/m^3	None	Silver-White, blue tinged, lustrous, odorless solid	Inhalation Ingestion	headache, nausea, chills, vomiting, diarrhea	Respiratory system, kidneys, prostate, blood
Lead	0.05 mg/m^3	0.100 mg/m^3	dense, ductile, soft, gray solid	Inhalation Ingestion Contact	Weakness, facial pallor, abdominal pain	Eyes, GI tract, kidneys, blood, gingival tissue

Notes:
PEL-Permissible Exposure Limit
STEL-Short Term Exposure Limit
GI-Gastrointestinal

Table 7-2

Health and Safety Hazards

HAZARD	DESCRIPTION	LOCATION	PROCEDURE USED TO MONITOR/REDUCE HAZARD
Heavy Equipment	Drill rigs, backhoes	Throughout the Site.	Personnel maintain eye contact with operators; hard hats, safety shoes, and eye & ear protection worn (as appropriate) during equipment operation.
Refuse and Material	Construction Material	Throughout the Site.	Maintain clean work areas, dispose of refuse immediately, do not block access routes with materials or debris.
Heat Producing/ Electrical Equipment	Generators, Vehicles, Steam Cleaners, Power Tools	Throughout the Site.	Operate equipment away from vegetation and materials that may ignite. Maintain firefighting equipment in the vicinity of operating equipment.
Heat Stress/Cold Exposure	Personnel working under temperature extremes are subject to adverse effects.	Throughout the Site.	Employ the buddy system. Each worker is responsible for visually monitoring his/her partner for signs of heat stress or cold exposure. Site safety personnel will also monitor site conditions and establish work/rest regimes in accordance with Appendix F.
Chemical Exposure	Personnel can be exposed to various compounds associated with the Site.	Soils and Groundwater	Follow guidelines in the Health and Safety Plan. Be familiar with the signs and symptoms of exposure and first aid procedures. Report suspected over-exposure to the supervisor immediately.

8.0 SITE MONITORING

Field activities associated with the Site may create conditions that cause contaminants to be released into the breathing zone or to come into contact with the skin of field personnel. However, the hazard associated with these conditions is suspected to be low. The most significant compounds and elements found in Table 7-1 that may be associated with site activities according to the Consent Decree and based on toxicity, reported results, and likelihood of exposure due to scheduled Closure field activities are as follows:

- Lead
- Cadmium

Monitoring of airborne dust concentrations with an MIE PDM-3® or equivalent instrument, will be performed during intrusive operations that have the potential to make airborne surface and subsurface soils. The intrusive operations include collecting soil samples with a geoprobe and soil sampling. Air monitoring within the breathing zone will be conducted at the initiation of each intrusive operation, then on an as-needed basis for each intrusive site activity, as determined by the Site Health and Safety Officer.

9.0 ACTION LEVELS

Action levels have been established for Personal Protective Equipment (PPE) use and implementation of additional safety precautions, as necessary. Level D-modified PPE, as described in Appendix D of this plan, has been established as a minimum requirement during all Closure field activities. Also, Level D-modified PPE will be required for those site operations and areas that do not pose a potential threat of exposure to hazardous substances (e.g., site walk through or surveying). Level C-modified PPE as described in Appendix D of this plan will be required as indicated by the site health and safety monitoring. Detailed PPE descriptions are presented in Appendix D.

Table 9-1 lists the action levels for the airborne concentrations of the potential site compounds, lead and cadmium, and the respective personal protection. If airborne dust levels reach or exceed the action levels described in this Plan for sampling activities inside the buildings, an upgrade of PPE (Level C-modified, Level C or B) will be required. The action level value of 5 mg/m^3 for the total airborne dust concentration will be used for upgrading PPE from Level D and Level D-modified to Level C or Level C-modified using a half face respirator. Whenever total airborne dust concentrations in the worker's breathing zone reaches or exceeds the value of 10 mg/m^3 the use of full face respirators is required. These action levels are based on the Permissible Exposure Limit (PEL) for cadmium as determined by OSHA. OSHA has established a PEL for cadmium of .005 mg/m^3 as a time-weighted average value for an eight-hour work day and a forty-hour week.

If airborne dust concentrations at the work site (i.e. soil sample) exceed 1.2 mg/m^3 for three consecutive readings taken five minutes apart, the potential dust emission source will be evaluated and additional dust control measures mobilized and implemented until dust emissions can be reduced to below the action level.

Table 9-1

Action Levels*

Amount of Airborne Dust as Measured in the Breathing Zone	Required Level of Protection
Background level to 5 mg/m^3	Level D or Level D-Modified
5 mg/m^3 to 50 mg/m^3	Level C or Level C-Modified**
>50 mg/m^3	Cease operations and re-evaluate dust control measures

* These levels are based on the PEL for Cadmium.
** Respirator cartridge must protect against dust.

10.0 ANTICIPATED PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS FOR CLOSURE ACTIVITIES

Task Activity	Anticipated Personal Protective Equipment
A. Soil Sampling	Level D
B. Sediment Sampling	Level D-Modified
C. Groundwater Sampling	Level D-Modified
D. Site Survey	Level D-Modified
E. Site Walk	Level D-Modified
F. Routine Inspections	Level D-Modified

11.0 DECONTAMINATION

It is expected that the highest level of personal protective equipment necessary during the site Closure field activities will be Level D. The appropriate decontamination procedures are presented in Appendix E of this HSP and will be followed when PPE is used. Personnel wearing PPE will be required to follow these decontamination procedures for clothing and equipment.

12.0 EMERGENCY RESPONSE

12.1 NOTIFICATION OF SITE EMERGENCIES

Medical personnel at the primary hospital, fire, and police departments will be informed by site Health and Safety Officer of site hazards and activities prior to project initiation so that potential emergency situations can be handled most efficiently.

Table 12-1 contains Emergency Response Telephone Numbers. This table will be maintained at the specific task work area by the Site Health and Safety Officer or his designee, in a readily accessible location for use in case of an emergency. In the event of an emergency, appropriate authorities will then be immediately notified of the nature and extent of the emergency.

12.2 RESPONSIBILITIES

The Site Health and Safety Officer or his designee will be responsible for responding to emergencies which may develop during the Closure field activities. The Site Health and Safety Officer or his designee will:

1. Notify appropriate individuals, authorities and/or health care facilities of the hazards of the field activities;

2. Ensure that safety equipment such as first aid supplies and fire extinguishers are available at the specific task work area;

3. Have working knowledge of all safety equipment available at the specific task work area;

4. Ensure that the Site to hospital directions (Section 12.5) that detail the most direct route to the nearest hospital are included with the emergency telephone numbers.

12.3 ACCIDENTS AND INJURIES

In the event of a safety or health emergency at the specific task work area, appropriate emergency measures will immediately be taken to assist those who have been injured or exposed and to protect others from hazards. The Site Health and Safety Officer or his designee will be immediately notified and will respond appropriately. The AGC Project Coordinator will be immediately informed.

12.4 COMMUNICATIONS

Mobile phones will be available to use during field activities for emergency response and office communications. Public telephones will be located by Site Health and Safety Officer prior to the start-up of activities as back up to the mobile phones or as the primary off-site communication network.

12.5 SITE TO HOSPITAL DIRECTIONS

In the event of a serious injury, an ambulance shall be summoned for transportation to the nearest hospital. In the event of minor injuries or illness, the Site Health and Safety Officer or his designee may elect to have the injured person transported to the nearest hospital by company vehicle. If there is any doubt about the severity of the injury, an ambulance shall be used.

Directions to St. Francis Hospital in Beech Grove, Indiana are as follows:

- Exit site/turn right onto South Arlington Avenue.
- Take Arlington Avenue to the first intersection (five way intersection) make a hard right onto Big Four Road.
- Take Big Four Road to South Emerson/1st Avenue and turn right.
- Take South Emerson/1st Avenue; turn to Albany Street and turn left.
- Go approximately nine (9) blocks, St Francis Hospital will be on the corner of Albany Street and 17th Avenue.

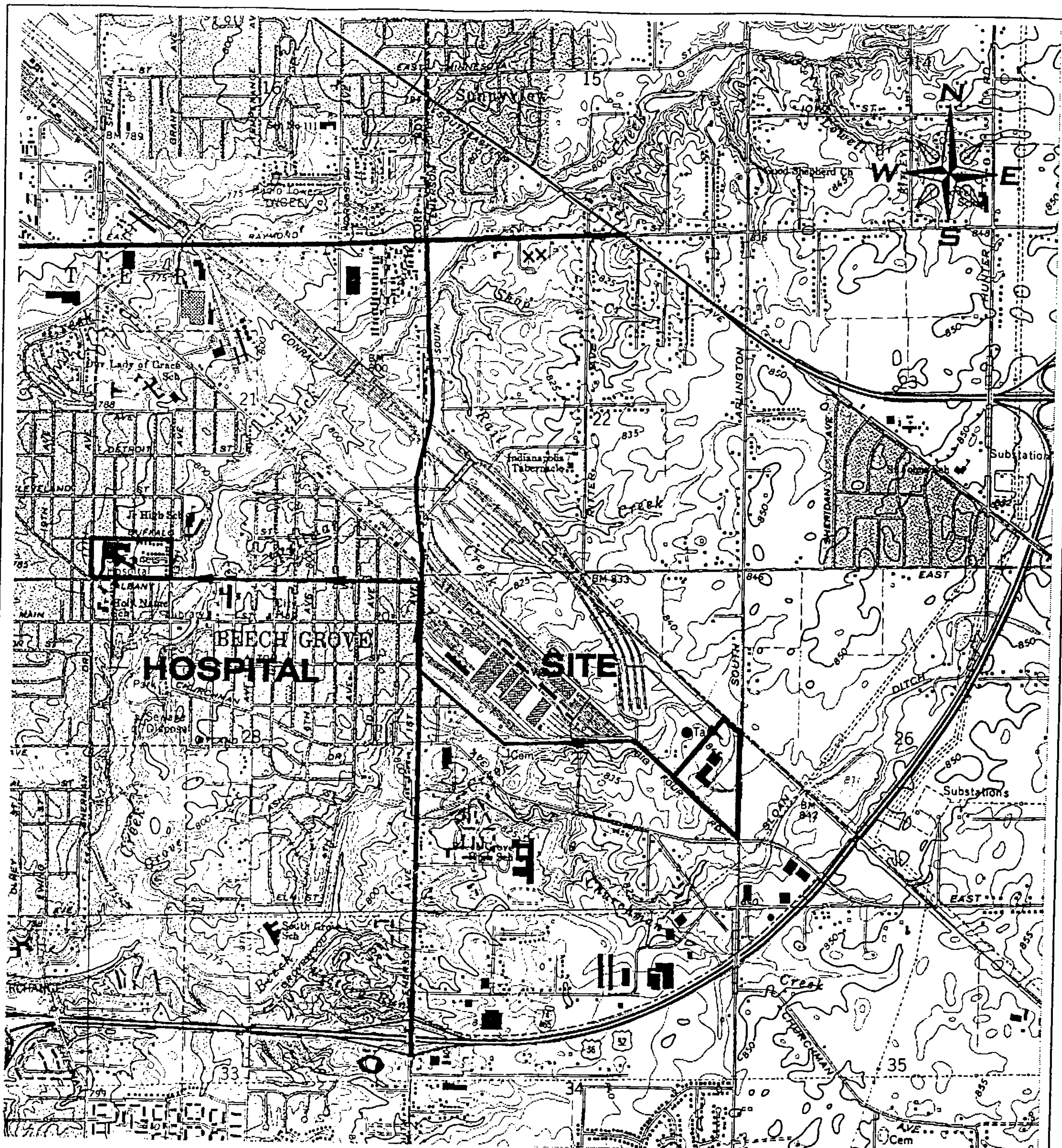
TABLE 12-1
EMERGENCY TELEPHONE NUMBERS

AGC Project Manager	*Paul G. Stratman, P.E.*	*(610) 558-3300 (w)* *(610) 701-9519(h)*
AGC Closure Task Manager	*Stephen Kirschner, P.E.*	*(610) 558-3300 (w)* *(610) 431-3443 (h)*
IDEM Project Coordinator	*Rebecca Eifert*	*(317) 232-3404 (w)*
National Response Center		*1 800 424-8802*

AGENCY	**TELEPHONE NUMBER**
Fire Department	*911 or (317) 784-4411*
Ambulance	*911 or (317) 783-8338*
Beech Grove Police	*911 or (317) 784-4411*
State Police	*(317) 232-8250*
St. Francis Hospital	*911 or (317) 783-8261 (Emergency Room)* *or (317) 787-3311 (General)*

NOTE: ***Marion County has an enhanced 911 service. The quickest way to obtain help from police, the fire department or the hospital is to use 911***

Figure 12-1 provides a map to the nearest hospital from the Site.



REFINED METALS CORPORATION
RCRA FACILITY INVESTIGATION WORK PLAN
BEECH GROVE, INDIANA

Date: 8/27/98	DIRECTIONS TO HOSPITAL
Scale: N.T.S.	
Drawn By: P.S.G.	
Checked By: S.W.K.	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Project Mgr: P.G.S.	
Dwg No. 98478-01	
Issued: AUG 2 7 1998	Project No. 98-478-01 / FIGURE: 12-1

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13.0 INCIDENT REPORTING PROCEDURE

Adherence to this site-specific Health and Safety Plan and any additional facility safety rules and regulations will significantly reduce the likelihood of personnel being exposed to toxic substances above permissible exposure limits and to physical hazards. However, in the event an incident does occur, it is imperative that specific reporting procedures be followed so that appropriate corrective action can be taken by the Site Health and Safety Officer and the Closure Task Manager. Upon notification of an incident, the Site Health and Safety Officer will contact the appropriate personnel for recommended medical diagnosis and, if necessary, treatment. The Closure Task Manager, Site Health and Safety Officer, and/or AGC Project Manager will investigate facility/site conditions to determine: (1) the severity of the incident, (2) the cause of the incident, and (3) the means to prevent the incident from re-occurring.

An Incident Reporting Form presented as page A-3 in Appendix A has been developed so that consistent and appropriate information is obtained regarding employee exposures. The form will be completed within 24 hours of an incident by the Site Health and Safety Officer and the exposed individual. The form will be filed at AGC with the employee's medical and safety records to serve as documentation of the incident and the actions taken.

Following any occupational incident that results in loss of consciousness, transfer to another job, medical treatment or restriction of work or motion, the incident must be entered on the Log of Summary of Occupational Injuries and Illnesses (OSHA No. 200) and the Supplementary Record of Occupational Injuries and Illness (OSHA No. 101). Both forms must be completed within six (6) days of the incident by the employer. OSHA No. 200 for the previous calendar year must be posted in an area where regular notices are posted for employees no later than February 1 and must remain posted until March 1.

OSHA No. 200 summaries must be held on file for at least five (5) years following the end of the calendar year for each respective summary log. This will allow for the inspection and copying of the logs at the discretion of the United States Department of Labor, and any states given the jurisdiction under the OSHA of 1970.

14.0 SPECIAL PRECAUTIONS AND PROCEDURES

The Site poses potential exposure risks for both chemical and physical hazards. The chemical risks have been explained in the previous sections. The potential for chemical exposure to hazardous substances is significantly reduced through the use of personal protective clothing, engineering controls, and implementation of safe work practices.

Other potential hazards that are associated with the site activities include working around heavy equipment, heat stress or cold exposure (depending on time of year), and site debris. Precautionary measures discussed in the following sections have been established to reduce these risks to a minimum during site activities.

14.1 HEAVY MACHINERY/EQUIPMENT

All site employees must remain aware of those site activities that involve the use of heavy equipment and machinery. Respiratory protection and protective eye wear may be required to be worn during site activities. This protective equipment significantly reduces peripheral vision of the wearer. Therefore, it is essential that all employees at the site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

14.2 CONSTRUCTION MATERIAL AND SITE REFUSE

All construction materials and site refuse should be contained in appropriate areas or facilities. All trash will be immediately and properly disposed. It is important to maintain clear areas of egress in case of an emergency.

14.3 HEAT STRESS/COLD EXPOSURE

It is anticipated that heat stress/cold exposure could be a significant factor in the health and safety of the workers. If heat stress does become a significant factor, monitoring will be employed as necessary so that personnel do not suffer adverse effects from heat stress. See Appendix F for specific heat stress factors, monitoring and prevention procedures.

The effects of cold exposure can be less apparent to the victim. It is extremely important that partners within the buddy system visually inspect their fellow workers often. Redness of the skin indicates the onset of cold exposure. A white or pale skin color, especially on extremities such as the nose, cheeks, chin, ears fingers, and toes are indications that frost bite is setting in. Individuals should dress in layers, peeling off each layer as they get warmer from exertion. The Site Health and Safety Officer should keep informed of the wind-chill factor and will inspect workers during cold exposure conditions. See Appendix F for specific cold exposure guidance.

14.4 ADDITIONAL SAFETY PRACTICES

The following are important safety precautions which will be enforced during the Closure field activities when contact with potential hazardous waste materials is possible.

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any field task work area.

2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.

3. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after departing the Site. At a minimum, personnel will be required to wash face and hands thoroughly upon departing the Site.

4. No excessive facial hair which interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit testing shall be performed prior to respirator use to ensure a proper seal is obtained by the wearer.

5. Medicine and alcohol can accentuate the effect from exposure to certain compounds. On-site personnel should consult with their physician regarding the use of prescribed drugs during the groundwater monitoring field activities. Alcohol or anyone exhibiting the affects of alcohol will not be permitted on the RMC site.

6. Authorized personnel and equipment in the work areas should be minimized, consistent with effective site operations.

7. Work areas for various operational activities must be established.

8. Procedures for leaving the work area will be planned and implemented by the Health and Site Safety Officer prior to going to the Site. Work areas and decontamination procedures will be established by the Site Health and Safety Officer on the basis of prevailing site conditions.

9. Respirators will be issued by each employer for the exclusive use of their employees and will be cleaned and disinfected after each use by the employee.

10. Safety gloves (supplied by the employer) and boots, if applicable, shall be taped to the disposable, chemical protective suits (supplied by the employer) as necessary.

11. Noise mufflers or ear plugs (supplied by the employer) may be required for all field personnel working around heavy equipment. This requirement will be at the discretion of the Site Health and Safety Officer. Disposable, form-fitting plugs are preferred.

12. If applicable, cartridges (supplied by the employer) for air-purifying respirators in use will be changed as directed by the Site Health and Safety Officer.

HSP

APPENDIX A
FORMS

PLAN ACCEPTANCE FORM
SITE HEALTH AND SAFETY PLAN
Closure FIELD ACTIVITIES

INSTRUCTIONS: This form is to be completed by each person working on the RMC site located in Marion County, Indiana and returned to Advanced GeoServices Corp. office located in Chadds Ford, Pennsylvania.

Job No. ______________________________

Project ______________________________

I represent that I have read and understand the contents of the Closure Site Health and Safety Plan for the RMC in Marion County, Indiana and agree to perform my work in accordance with it.

____
Signed

____
Print Name

____
Company

____
Date

CONTRACTOR/SUBCONTRACTOR
HEALTH AND SAFETY COMPLIANCE CERTIFICATION

Project Name____________________________ Project Number____________

Contractor/Subcontractor: Name____________________________________

Address____________________________________

____

Phone Number____________________________________

1. Contractor/subcontractor certifies that the following personnel to be employed during the Consent Decree field activities have met the requirements of the OSHA Hazardous Waste Operation Standard (29 CFR 1910.120) and all other applicable OSHA standards as required by the RMC Consent Decree Site Health and Safety Plan.

Contractor/Subcontractor Personnel	Training	Respirator Certification	Medical Exam
example: John Smith	3/6/95 AGC	3/6/95 AGC (small MSA)	3/7/95 West Chester

2. Contractor/Subcontractor certifies that it has received a copy of the RMC's Closure Site Health and Safety Plan and will be responsible for their employees compliance with its requirements.

3. Contractor/Subcontractor further certifies that it has read and understands and will comply with all provisions of its contractual agreement.

____________________________________ ____________________

Owners (Contractor/Subcontractor) signature Date

INCIDENT REPORTING FORM

CLIENT NAME: ____________________

NAME OF PERSON REPORTING INCIDENT: ____________________

DATE OF INCIDENT: ____________________ TIME OF INCIDENT: ____________________

LOCATION OF INCIDENT: ____________________

NAME OF INJURED PERSON: ____________________

EMPLOYEE JOB TITLE: ____________________

TYPE OF INCIDENT: ____________________

NATURE AND EXTENT OF INJURY: ____________________

SPECIFIC TASK AT TIME OF INCIDENT: ____________________

LEVEL OF PERSONAL PROTECTIVE EQUIPMENT WORN AT TIME OF INCIDENT: ____________________

WAS FIRST AID GIVEN? ________ IF SO, WHEN, BY WHOM? ____________________

NAME AND ADDRESS OF DOCTOR/HOSPITAL: ____________________

____

BRIEF SUMMARY OF INCIDENT: ____________________

____

SUMMARIZE WHAT YOU CONSIDER CAUSE THE INCIDENT: ____________________

____

SUGGESTED PREVENTIVE MEASURES: ____________________

____

CORRECTIVE ACTIONS TAKEN: ____________________

____

EMPLOYEE SIGNATURE: ____________________

SITE HEALTH AND SAFETY OFFICER SIGNATURE: ____________________

AGC PROJECT COORDINATOR SIGNATURE: ____________________

TIME & DATE OF REPORT: ____________________

APPENDIX B

PERSONNEL TRAINING

General site workers (such as equipment operators, general laborers and supervisory personnel) engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances and health hazards shall receive a minimum of 40 hours of classroom instruction, and a minimum of three days actual field experience under the direct supervision of a trained, experienced supervisor. The training course must have included the following material at a minimum:

1. Health and Safety Officer and Site Management Responsibilities. -personnel must understand Health and Safety Officer and Site Management responsibilities and authority.

2. Site-Specific Health and Safety Hazards - personnel must be informed of specific hazards related to site and site operations.

3. Personal Protection Equipment (PPE) - personnel must be trained in proper use of personal protective equipment.

4. Safe Work Practices/Engineering Controls - personnel must be informed of appropriate work practices and engineering controls that will reduce the risk of exposure to site hazards.

5. Safety Equipment Use - personnel must understand the use of monitoring instruments and other safety equipment.

6. Medical Surveillance Program - personnel must be informed of requirements for medical surveillance of hazardous waste site employees.

7. Site Control Methods - personnel must understand site methods used to reduce exposure to on-site personnel.

8. Decontamination Procedures - personnel must be trained in proper decontamination operation and procedures.

9. Emergency Response - personnel must be trained in proper emergency response operation and procedures.

10. Confined Space Entry/Special Hazards - personnel involved in specific hazardous activities, such as confined space entry and drum handling, must receive training in appropriate techniques to employ during such operations.

Workers on site only occasionally for a specific limited task (such as, but not limited to, land surveying or site walk through) and who are unlikely to be exposed over permissible exposure limits and published exposure limits shall receive a minimum of 24 hours of classroom instruction and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

Workers regularly on site who work in areas which have been monitored and fully characterized indicating that exposures are under permissible exposure limits, where respirators are not necessary, and the characterization indicates that there are no health hazards or the possibility of an emergency developing, shall receive a minimum of 24 hours of instruction off the site and the minimum of one day actual field experience under the direct supervision of a trained, experienced supervisor.

Workers with 24 hours of training who meet the criteria for 24 hour training cited above, and who become general site workers or who are required to wear respirators, shall have the additional 16 hours and two days of training necessary to total the training specified for the 40 hour training criteria.

Health and Safety training programs shall comply with criteria set forth by OSHA as per final regulation 29 CFR 1910.120. This program will instruct employees on general health and safety principles and procedures, proper operation of monitoring instruments, and use of personal protective equipment.

In addition, field employees will undergo site-specific training prior to the start-up of any given task. As activities change at a particular site, related training will address potential hazards and associated risks, site operating procedures, emergency response, and site control methods to be employed.

Specialized training will be provided as dictated by the nature of the project activities. Specialized training will be provided for activities such as confined space entry, excavations and handling of unidentified substances. However, none of these activities are anticipated for the RMC Site. Employees involved in these types of activities will be given off-site instruction regarding the potential hazards involved with safety activities and the appropriate health and safety procedures to be followed. Off-site instruction is meant to include any area where employees will not be exposed to site hazards.

This Health and Safety Plan must be distributed to all contractor/ subcontractors prior to the start of field activities. A pre-operation meeting will be held to discuss the contents of the Plan. Specialty training will be provided as determined by task and responsibility. All training of AGC personnel will be conducted under direct supervision of the Health and Safety Officer or his designee. Exemption from training may be approved by the Health and Safety Officer in conjunction with the Project Coordinator.

HSP

APPENDIX C
MEDICAL MONITORING

APPENDIX C

MEDICAL MONITORING

The Occupational Safety and Health Administration (OSHA) has established requirements for a medical surveillance program designed to monitor and reduce health risks for employees potentially exposed to hazardous materials (29 CFR 1910.120). This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations including field activities, and to determine his/her ability to wear personal protective equipment, such as chemical resistant clothing and respirators. Employees who wear or may wear respiratory protection must be provided respirators as regulated by 29 CFR 1910.134. This Standard requires that an individual's ability to wear respiratory protection be medically certified before he/she performs designated duties. Where medical requirements of 20 CFR 1910.120 overlap those of 29 CFR 1910.134, the more stringent of the two will be enforced.

The medical examination must be administered on a pre-employment and annual basis and as warranted by symptoms of exposure or specialized activities. These examinations shall be provided by employers without cost or loss of pay to the employee.

The medical examination shall include at the minimum the following:

1. Medical History and Physical, including:
   - Medical questionnaire;
   - Completion of medical history with occupational risk factor analysis;
   - Examination by physician;
   - Evaluation of test results; and
   - Brief report sent to employer covering specific requested areas as well as pertinent positive findings; report sent to family physician and employee by request;
2. Pulmonary Function Testing;
3. Electrocardiogram (baseline, and at the discretion of examining physician);
4. Chest X-Ray (baseline, and at the discretion of examining physician);

5. Lab Tests, including:

    - Urinalysis;
    - Blood Chemistry Profile;
    - Complete blood Count with differential;

6. Vision Screen; and

7. Audiogram.

The examining physician is required to make a report to the employer of any medical condition which would place such employee at increased risk of wearing a respirator or other personal protective equipment. Each employer engaged in site work shall assume the responsibility of maintaining site personnel medical records as regulated by 29 CFR 1910.120, where applicable. Exemption from the medical surveillance program may be allowed by the Health & Safety Officer in conjunction with the Project Manager. These exemptions will be based on their interpretation of the requirements of 1910.120 relative to each individual exemption request.

Basically, an employee is required by federal regulation to have medical monitoring if the employee is or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits for these substances, without regard to the use of respirators, for 30 days or more a year.

All employers contracted to work at the site designated by this plan will be responsible to ensure their employees have received the proper medical tests as regulated by 29 CFR 1910.20 and shall provide AGC with certification of same.

HSP

APPENDIX D
PERSONAL PROTECTIVE EQUIPMENT

APPENDIX D

PERSONAL PROTECTIVE EQUIPMENT

PROTECTIVE EQUIPMENT

All personnel must be provided with appropriate personal safety equipment and protective clothing by their employer. Each individual will be properly trained in the use of this safety equipment before the start of field activities. Safety equipment and protective clothing shall be used as directed by the Site Health and Safety Officer. All such equipment and clothing will be cleaned and maintained in proper condition by project personnel. The Site Health and Safety Officer will monitor the maintenance of personal protective equipment to ensure proper procedures are followed.

Personal protective equipment will be worn at all appropriate times, as designated by the Health and Safety Plan. Levels of protective clothing and equipment have been assigned to specific work tasks (Section 10.0).

The personal protective equipment levels designated below are in conformance with EPA criteria for Levels B, C, and D protection. In addition, Level C-Modified and Level D-Modified personal protection has been developed for specific tasks. However, Level B or Level C protection is not anticipated for any of the RMC Site Closure field activities. All respiratory protective equipment use will be approved by NIOSH/MSHA.

LEVEL B PROTECTION

A. Pressure demand cascade air-line system or other suitable self-contained, pressure demand breathing apparatus.

B. Chemical-resistant clothing such as Tyvek®, Poly-coated Tyvek®, or Saranex®. Suits will be one piece with hoods, booties and elastic wrist bands.

C. Outer nitrile and inner latex surgical gloves

D. Steel toe boots with rubber overboots

E. Water-resistant tape over protective clothing as necessary

F. Hard hat

G. Options as required:

1. Coveralls
2. Disposable outer boots
3. Face shield
4. Escape mask
5. Hearing protection

LEVEL C PROTECTION

A. Full-face or half-face air purifying respirator equipped with appropriate organic vapor/dust canisters or cartridges.

B. Chemical-resistant clothing such as Poly-coated Tyvek® or Saranex®.

C. Outer nitrile gloves and inner latex surgical gloves

D. Steel toe boots with rubber overboots

E. Hard Hats

F. Safety Glasses

G. Options as required:

1. Coveralls
2. Disposable outer boots
3. Escape mask
4. Face shield
5. Hearing protection
6. Water-resistant tape

LEVEL C-MODIFIED PROTECTION

A. Full-face or half-face air purifying respirator equipped with appropriate organic vapor/dust canisters or cartridges.

B. Coveralls or long sleeve shirts and pants.

C. Outer nitrile gloves and inner latex surgical gloves.

D. Steel toe boots

E. Hard Hats

F. Safety Glasses

G. Options as required:

  1. Disposable outer boots
  2. Escape mask
  3. Face shield
  4. Hearing protection
  5. Water-resistant tape

LEVEL D PROTECTION

A. Coveralls or long sleeve shirts and long pants, unless otherwise directed by the Health and Safety Officer.

B. Outer nitrile gloves at a minimum for all hazardous or potentially hazardous material handling activities. Inner latex surgical gloves are recommended where practical.

C. Steel toe boots

D. Hard hat

E. Safety glasses

F. Options as required:

  1. Disposable outer boots
  2. Hearing protection

LEVEL D-MODIFIED PROTECTION

A. Outer nitrile gloves at a minimum for all hazardous or potentially hazardous material handling activities. Inner latex surgical gloves are recommended where practical.

B. Steel toe boots

C. Safety glasses

D. Options as required:

  1. Disposable outer boots
  2. Hearing protection
  3. Hard Hats

HSP

APPENDIX E
DECONTAMINATION

APPENDIX E

DECONTAMINATION

E-1 GENERAL

Personnel involved with hazardous material handling may be exposed to compounds in a number of ways, despite the most stringent protective procedures. Personnel may come in contact with particulates in the air, or may come in contact with site media while performing specific work tasks. Use of monitoring instruments and equipment can also result in exposure to hazardous substances.

In general, decontamination involves scrubbing with a non-phosphate soap/water solution followed by clean water rinses. All disposable items will be disposed of in a dry container. Certain parts of contaminated respirators, such as harness assemblies and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in soap and water and scrubbed with a brush. In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before they can be used again unless they are assigned to individuals. The manufacturer's instructions should be followed in sanitizing the respirator masks. The Site Health and Safety Officer or his designee will be responsible for supervising the proper decontamination of protective equipment.

E-2 STANDARD PPE DECONTAMINATION

The Site Health and Safety Officer or his designee will monitor decontamination procedures to ensure their effectiveness. Modifications of the decontamination procedure may be necessary as determined by the Site Health and Safety Officer or his designee. Decontamination procedures for PPE Level B, C and D are as follows:

Level B - Personal Protection Decontamination Procedure

Step 1 - Segregated Equipment Drop

Deposit equipment (tools, sampling devices, notes, monitoring instruments, radios, etc.) used on the site onto plastic drop cloths.

Step 2 - Boot Covers and Glove Wash

Outer boot covers and outer gloves should be scrubbed with a decontamination solution of detergent and water.

Step 3 - Rinse Off Boot Covers and Gloves

Decontamination solution should be rinsed off boot covers and gloves using generous amounts of water. Repeat as many times as necessary.

Step 4 - Tape Removal

Remove tape from around boots and gloves and place into container with plastic liner.

Step 5 - Boot Cover Removal

Remove disposable boot covers and place into container with plastic liner.

Step 6 - Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Step 7 - Suit/Safety Boot Wash

Completely wash splash suit, SCBA, gloves, and safety boots. Care should be exercised that no water is allowed into the SCBA regulator.

Step 8 - Suit/Safety Boot Rinse

Thoroughly rinse off all decontamination solution from protective clothing.

Step 9 - Tank Changes

This is the last step in the decontamination procedure for those workers wishing to change air tanks and return to the exclusion zone. The worker's air tank is exchanged, new outer glove and boot covers are donned, and joints taped.

Step 10 - Removal of Safety Boots

Remove safety boots and deposit in container with a plastic liner.

Step 11 - SCBA Backpack Removal

Without removing face piece, remove the SCBA backpack and place it on a table. Then disconnect the face piece from the remaining SCBA unit and proceed to the next station.

Step 12 - Splash Suit Removal

With care, remove splash suit. The exterior of the splash suit should not come in contact with any inner layers of clothing.

Step 13 - Inner Glove Wash

The inner gloves should be washed with a mild decontamination solution (detergent/water).

Step 14 - Inner Glove Rinse

Generously rinse inner gloves with water.

Step 15 - Face Piece Removal

Without touching face with gloves, remove face piece. Deposit face piece into a container which has a plastic liner.

Step 16 - Inner Glove Removal

Remove inner glove and deposit in container with plastic liner.

Step 17 - Field Wash

Wash hands and face thoroughly. If highly toxic, skin corrosive, or skin-absorbent materials are known or suspected to be present, take a shower or a sponge bath as soon as possible.

<u>Level C Personal Protection Decontamination Procedure (Use Appropriate Decontamination Procedures for Level C-Modified</u>

Step 1 - Segregated Equipment Drop

Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduced the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.

Step 2 - Boot Cover and Glove Wash

Scrub outer boot covers and gloves with decontamination solution of detergent and water.

Step 3 - Boot Cover and Glove Rinse

Rinse off decontamination solution from station 2 using generous amounts of water. Repeat as many times as necessary.

Step 4 - Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Step 5 - Boot Cover Removal

Remove boot covers and deposit in container with plastic liner.

Step 6 - Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Step 7 - Suit and Boot Wash

Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decontamination solution.

Step 8 - Suit and Boot, and Glove Rinse

Thoroughly rinse off decontamination solution using water. Repeat as many times as necessary.

Step 9 - Canister or Mask Change

If worker leaves exclusion zone to change canister or mask, this is the last step in the decontamination procedure. Worker's canister and/or mask is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.

Step 10 - Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Step 11 - Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Step 12 - Inner Glove Wash

Wash inner gloves with decontamination solution.

Step 3 - Rinse Off Boot Covers and Gloves

Decontamination solution should be rinsed off boot covers and gloves using generous amounts of water. Repeat as many times as necessary.

Step 4 - Tape Removal

Remove tape from around boots and gloves and place into container with plastic liner.

Step 5 - Boot Cover Removal

Remove disposable boot covers and place into container with plastic liner.

Step 6 - Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Step 7 - Suit/Safety Boot Wash

Completely wash splash suit, SCBA, gloves, and safety boots. Care should be exercised that no water is allowed into the SCBA regulator.

Step 8 - Suit/Safety Boot Rinse

Thoroughly rinse off all decontamination solution from protective clothing.

Step 9 - Tank Changes

This is the last step in the decontamination procedure for those workers wishing to change air tanks and return to the exclusion zone. The worker's air tank is exchanged, new outer glove and boot covers are donned, and joints taped.

Step 10 - Removal of Safety Boots

Remove safety boots and deposit in container with a plastic liner.

Step 11 - SCBA Backpack Removal

Without removing face piece, remove the SCBA backpack and place it on a table. Then disconnect the face piece from the remaining SCBA unit and proceed to the next station.

Step 12 - Splash Suit Removal

With care, remove splash suit. The exterior of the splash suit should not come in contact with any inner layers of clothing.

Step 13 - Inner Glove Wash

The inner gloves should be washed with a mild decontamination solution (detergent/water).

Step 14 - Inner Glove Rinse

Generously rinse inner gloves with water.

Step 15 - Face Piece Removal

Without touching face with gloves, remove face piece. Deposit face piece into a container which has a plastic liner.

Step 16 - Inner Glove Removal

Remove inner glove and deposit in container with plastic liner.

Step 17 - Field Wash

Wash hands and face thoroughly. If highly toxic, skin corrosive, or skin-absorbent materials are known or suspected to be present, take a shower or a sponge bath as soon as possible.

<u>Level C Personal Protection Decontamination Procedure (Use Appropriate Decontamination Procedures for Level C-Modified</u>

Step 1 - Segregated Equipment Drop

Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduced the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.

Step 2 - Boot Cover and Glove Wash

Scrub outer boot covers and gloves with decontamination solution of detergent and water.

Step 3 - Boot Cover and Glove Rinse

Rinse off decontamination solution from station 2 using generous amounts of water. Repeat as many times as necessary.

Step 4 - Tape Removal

Remove tape around boots and gloves and deposit in container with plastic liner.

Step 5 - Boot Cover Removal

Remove boot covers and deposit in container with plastic liner.

Step 6 - Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Step 7 - Suit and Boot Wash

Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decontamination solution.

Step 8 - Suit and Boot, and Glove Rinse

Thoroughly rinse off decontamination solution using water. Repeat as many times as necessary.

Step 9 - Canister or Mask Change

If worker leaves exclusion zone to change canister or mask, this is the last step in the decontamination procedure. Worker's canister and/or mask is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.

Step 10 - Safety Boot Removal

Remove safety boots and deposit in container with plastic liner.

Step 11 - Splash Suit Removal

With assistance of helper, remove splash suit. Deposit in container with plastic liner.

Step 12 - Inner Glove Wash

Wash inner gloves with decontamination solution.

Step 13 - Inner Glove Rinse

Rinse inner gloves with water.

Step 14 - Face Piece Removal

Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers.

Step 15 - Inner Glove Removal

Remove inner gloves and deposit in container with liner.

Step 16 - Field Wash

Wash hands and face with soap and water. Shower or sponge bath if highly toxic, skin-corrosive or skin absorbable materials are known or suspected to be present.

<u>Level D Personal Protection Decontamination Procedure (Use Appropriate Decontamination Procedures for Level D-Modified</u>

Step 1 - Boot Cover and Glove Wash (if applicable)

Scrub outer boot covers and gloves with decontamination solution or detergent and water.

Step 2 - Boot Cover and Glove Rinse (if applicable)

Rinse off decontamination solution from station 1 using generous amounts of water.

Step 3 - Boot Cover Removal (if applicable)

Remove boot covers and deposit in container with plastic liner.

Step 4 - Glove Removal (if applicable)

Remove gloves and deposit in container with plastic liner.

Step 5 - Coverall Removal (if applicable)

Remove coverall and deposit in container with plastic liner.

Step 6 - Field Wash

Wash hands and face with soap and water.

HSP

APPENDIX F
TEMPERATURE EXTREME GUIDELINES

APPENDIX F

TEMPERATURE EXTREME GUIDELINES

F-1 HEAT STRESS

The physical work activities during the Closure Field Activities are anticipated to be low. However, if applicable, the Site Health and Safety Officer has the responsibility to monitor heat stress throughout each field task and to make work/rest recommendations as appropriate.

PHYSIOLOGICAL FACTORS

Physical Condition: Physical fitness is a major factor influencing a persons ability to perform work. A fit person, relative to an unfit person, will have:

Less physiological strain
Lower heart rate
Lower body temperature
More efficient sweating mechanism
Slightly lower oxygen consumption
Slightly lower carbon dioxide production

Level of acclimatization is the degree to which a workers body has physiologically adjusted to working under hot environments. An acclimatized person generally:

- Has lower heart rates and body temperature.
  Sweats sooner and more profusely.
  Sweat contains lower levels of electrolytes.

- Acclimatized persons enclosed in a impermeable suit sweat more profusely and therefore actually face a greater danger of heat exhaustion due to rapid dehydration.

Age:

Maximum work capacity usually declines with increasing age, but not always.

Gender:

Females tolerate heat as well as males.
Females work capacity averages 10% - 30% less than males.

Height:

The ability of a body to get rid of heat depends on the ratio of its surface area to its weight.

HEAT RELATED DISORDERS

During the summer months, or in hot and humid environments, heat related illnesses are a serious problem. Those at risk are workers not acclimatized and/or those wearing impermeable clothing. The four most common heat related disorders are shown from least to most serious as follows.

Heat Rash:

The most common heat rash is prickly heat, which appears as red bumps. It usually occurs in areas where the clothing is restrictive. The rash areas can become easily infected if not treated and allowed to dry.

Heat Cramps:

These are not uncommon in individuals who work hard in the heat. They are attributable to a continued loss of salt, accompanied by large intakes of water without appropriate replacement of electrolytes. Cramps often occur in the muscles principally used during work and can be treated by rest, ingestion of water, and electrolyte solution.

Heat Exhaustion:

- Symptoms:

  - Fatigue
  - Weakness
  - Headache
  - Vomiting
  - Fainting
  - Pale, clammy skin*
  - Normal body temperature*
  - Profuse sweating*
  - Dilated pupils

  * Denotes major differences between Heat Exhaustion and Heat Stroke.

- Treatment:

  - Remove from hot area
  - Apply cool cloths
  - Loosen or remove clothing

  Allow small sips of water or electrolyte solution, if victim is conscious and not vomiting.

- Causes:

  - High air temperatures
  - High humidity
  - Low air movement
  - Hard work
  - Insufficient fluid intake
  - Not enough breaks
  - Impermeable clothing

- Preventative Steps:

  - Wise use of breaks
  - Replenishment of fluids
  - Common sense

  Do not use soft drinks, coffee, tea, or any caffeine substance as a substitute for fluids on breaks.

Heat Stroke:

- Symptoms:

  - Dizziness
  - Confusion
  - Collapse
  - Angry behavior
  - Delirium
  - Hot, dry skin*
  - Elevated core temperature*
  - Red Skin*
  - Constricted pupils*

* Denotes major differences between Heat Exhaustion and Heat Stroke.

THIS IS A MEDICAL EMERGENCY!

- Treatment:

  - Remove from hot area
  - Remove clothing
  - Cool person down as quickly as possible

- Causes:

  - High air temperature
  - High humidity
  - Low air movement
  - Hard work
  - Insufficient fluid intake
  - Lack of breaks
  - Impermeable clothing

- Preventative Steps:

  - Sufficient number of fluid breaks
  - Replenishment of fluids
  - Common sense

  Do not drink soft drink, coffee, tea, or any type of caffeine drink as a substitute for fluids on breaks.

MONITORING

Because the incidence of heat stress depends on a variety of factor, all workers (if applicable) even those not wearing protective equipment, should be monitored.

For workers wearing semipermeable or impermeable encapsulating ensembles, workers should be monitored when the temperature in the work area is above 70°F (21°C).

To monitor the workers for heat stress measure:

Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.

- If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

- If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third.

Oral temperature. Use a clinical thermometer (3 minutes under the tongue or similar device to measure the oral temperature at the end of the work period (before drinking).

- If oral temperature exceeds 99.6° (37.6°C) shorten the next work cycle by one-third without changing the rest period.

- If oral temperature still exceeds 99.6° (37.6°C) at the beginning of the next rest periods, shorten the following work cycle by one third.

- Do **not** permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).

PREVENTION

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat injuries. To avoid heat stress, management may take the following steps:

Adjust work schedules:

- Modify work/rest schedules according to monitoring requirements
- Mandate work slowdowns as needed.
- Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.
- Add additional personnel to work teams.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.

Maintain workers body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, i.e., 8 fluid ounces (0.23 liters) of water must be ingested for approximately every 8 ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature at 50° to 60°F (10° to 15.6°C).
- Provide small disposable cups that hold about 4 ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Weigh workers before and after work to determine if fluid replacement is adequate.

Encourage workers to maintain an optimal level of physical fitness:

- Where indicated, acclimatize workers to site work conditions: temperature, protective clothing and workload. Acclimatization can occur after just a few days of exposure to a hot environment. NIOSH recommends a progressive 6-day acclimatization period for the unacclimatized worker before allowing him/her to do full work on a hot job. Under this regimen, the first day of work on site is begun using only 50 percent of the anticipated workload and exposure times, and 10 percent is added each day through day 6. With fit or trained individuals, the acclimatization period may be shortened 2 or 3 days. However, workers can lose acclimatization in a matter of days. and work regiments should be adjusted to account for this.

- Urge workers to maintain normal weight levels.

Provide cooling devices to aid natural body heat exchange during prolonged work or sever heat exposure. Cooling devices include:

- Field showers or hose-down areas to reduce body temperature and/or to cool off protective clothing.

- Cooling jackets, vests or suits.

Train workers to recognize and treat heat stress. As part of training, identify the signs and symptoms of heat stress.

F-2 COLD EXPOSURE

Personnel working outdoors in low temperatures are subject to cold exposure. Toes, fingers, ears, cheeks, and the nose are especially vulnerable to cold exposure.

Factors influencing the development of a cold injury include ambient temperature, wind velocity, humidity, type of exposure, and duration of exposure. Frostbite and hypothermia are two cold injuries which may occur.

Frostbite is a local injury resulting from cold exposure. It is characterized by a white or pale coloring of the skin. Its symptoms are exhibited in the following stages:

- Just before frostbite occurs, the affected skin may be slightly flushed;

- The skin changes to white or grayish-white in appearance;

- Pain is sometimes felt early but subsides later (often there is no pain);

- Blisters may appear later;

- The affected part feels intensely cold and numb; and

- The victim frequently is not aware of frostbite.

The objectives of first aid are to protect the frozen area from injury, to warm the affected area rapidly, and to maintain respiration.

Hypothermia is an overall cooling of the body. Progressive clinical presentations of hypothermia are presented in Table F-1.

To avoid cold exposure injuries, personnel should dress in layers, removing clothing as they generate heat from working. The buddy system must be instituted to ensure signs of frostbite or hypothermia will be noted as soon as possible. Generally, it is easier for someone else to see theses signs before the person who is exhibiting them will notice. A work-rest regimen, designated by the Site Health and Safety Officer, should be implemented early to avoid personnel casualties. If any cold exposure injuries are detected, the Site Health and Safety Officer must be notified immediately.

Table F-1

PROGRESSIVE CLINICAL PRESENTATIONS OF HYPOTHERMIA*

Core Temperature °C	°F	Clinical Signs
37.6	99.6	"Normal" rectal temperature
37	98.6	"Normal" oral temperature
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35	95.0	Maximum shivering
34	93.2	Victim conscious and responsive, with normal blood pressure
33	91.4	Sever hypothermia below this temperature
32	89.6	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated but react to light; shivering ceases
31	87.8	
30	86.0	Progressive loss of consciousness; muscular rigidity increases; pulse and blood pressure difficult to obtain; respiratory rate decreases
29	84.2	
28	82.4	Ventricular fibrillation possible with myocardial irritability
27	80.6	Voluntary motion ceases; pupils nonreactive to light; deep tendon supeClosurecial reflexes absent
26	78.8	Victim seldom conscious
25	77.0	Ventricular fibrillation may occur spontaneously
24	75.2	Pulmonary edema
22	71.6	Maximum risk of ventricular fibrillation
21	69.8	
20	68.0	Cardiac standstill
18	64.4	Lowest accidental hypothermia victim to recover
17	62.6	Isoelectric electroencephalogram
9	48.2	Lowest artificially cooled hypothermia patient to recover

* Presentations approximately related to core temperature. Reprinted from the January 1982 issue of *American Family Physician*, published by the American Academy of Family

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN
FOR THE
REFINED METALS CORPORATION SITE

Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

October 12, 1998
98-478-02

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APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

FOR THE

REFINED METALS CORPORATION SITE

Prepared For:

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Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

October 12, 1998
98-478-02

Quality Assurance Project Plan for the Refined Metals Corporation Site Beech Grove, Indiana

Revision 1

September 23, 1998

Approved by:

Paul Stratman P.E., AGC Project Manager Advanced GeoServices Corp.	Date
Denise McGuire, Quality Assurance Manager Advanced GeoServices Corp.	Date
Douglas E. Kriscunas, Laboratory Program Manager TriMatrix Laboratories, Inc.	Date
Matthew Love, Project Manager Refined Metals Corporation	Date
Craig Barker, Project Manager IDEM	Date

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Title and Signature page

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ATTACHMENT

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C	Field Audit Checklist
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List of Persons Who Have Received This QAPP

AGC
Exide Corporation
Indiana DEM
U.S. Department of Justice

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

On behalf of Refined Metals Corporation (RMC) Advanced GeoServices Corp. (AGC) has prepared this QAPP for the proposed RFI activities at the RMC Facility in Beech Grove, Indiana (Site). A Project Management Plan, Quality Assurance Project Plan (QAPP), Health and Safety Plan, and Community Relations Plan have been appended to the RCRA Facility Investigation (RFI) Work Plan, dated August 27, 1998.

1.1.1 Quality Assurance Project Plan Purpose

This Quality Assurance Project Plan describes the specific technical and data objectives and goals needed to monitor the concentrations of site-related metals in the groundwater, soil, dust, and sediment at the Site. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analysis will be described. All quality assurance/quality control (QA/QC) procedures will be structured in accordance with applicable technical standards, U.S. EPA's requirements, regulations, guidance and technical standards. This QAPP has been prepared in accordance with the Region 5 QAPP policy as presented in U. S. EPA RCRA QAPP Instructions, dated April 1998. Originally, the QAPP was performed using Region 5 QAPP policy dated May 1993 and submitted to the client for review, upon which the new QAPP policy (April 1998) was identified.

1.1.2 Project Objectives and Intended Data Uses

The objective of the RFI is to evaluate and determine the nature and extent of releases and to collect information necessary to support a corrective measures study, if required . Overall objectives of data collection will be as followed:

- Verify and further define the presence, magnitude, extent, and mobility of hazardous waste and hazardous waste constituents on and beneath the former site area and adjacent off-site areas that may have originated from the RCRA permitted hazardous waste or solid waste management units at the Site.

- Collect sufficient data for groundwater, soil, sediment and building interior dust to support a Corrective Measures Study to evaluate and develop alternatives and recommend a final corrective measure.

The Decision Statement for this investigation is as follows: **Identify the nature and extent of select RCRA metals in on-site and off-site soil, sediment, groundwater and building interior dust that present unacceptable risks, which would therefore warrant remedial action.**

1.2 SITE/FACILITY

The Refined Metals Corporation Site encompasses approximately 24 acres and is located in central Indiana, Marion County. The Site is located at 3700 Arlington Avenue, Beech Grove, Indiana, and is bordered by industrial and commercial facilities, and vacant lots.

Refined Metals Corporation was engaged in recycling lead batteries and other lead wastes. There are currently no manufacturing operations at the facility. The plant was constructed in 1968 as a secondary lead smelter. In 1984, a battery breaker operation was installed. From April 14, 1995, through December 31, 1995, operations were reduced to enriching and casting lead ingots from off-specification lead products. Since 1996, no production has taken place and the facility has been inactive.

The facility was constructed to recycle lead batteries and other lead wastes. Automotive batteries constituted 90 percent of the materials recycled, and the remainder was waste material from battery manufacturers and other lead scrap. During operation, the batteries were temporarily stored in trailers or on pallets in a paved storage yard. The batteries were then fed into the battery crusher, where the tops of the batteries were sawed off and the sulfuric acid was drained into a stainless steel tank that drained to the wastewater treatment system. The battery casings and their contents were tumbled and crushed. Lead plates and other lead parts were separated and transported to the materials storage building to be later placed in the furnace. The battery casings were shredded and separated into plastic and rubber in a flotation tank. The plastic was blown into a trailer for sale to be sold to an off-site recycler. Rubber was stored and then fed into the blast furnace.

Before 1984, materials were stored on-site with minimal spill or runoff control. Storm water runoff from the storage piles and work areas flowed to the storage pond and evaporated; some runoff flowed off site to the north drainage ditch. Once the battery crusher was installed in 1984, a batch neutralization system was installed to treat acidic wastewater from the battery crushing and flotation systems. The wastewater was neutralized before discharging to Beech Grove Municipal Sanitary Sewer system. Since 1988, all stormwater has been contained and routed to the wastewater treatment system.

Reportedly, underground storage tanks (USTs) were never used at the site. Three above ground storage tanks (ASTs) - two 10,000-gallon (ASTs) and one 20,000-gallon AST - were used to store diesel fuel for company trucks. The tanks were reportedly cleaned out in 1985 and are out of service. The three tanks are enclosed by a spill containment wall which was reportedly constructed before 1980. A 500-gallon AST and a 750-gallon AST were used for diesel fuel and gasoline, respectively, to fuel on-site vehicles. The 750-gallon gasoline tank is enclosed within a spill containment wall and pad. Propane, which is used to power forklifts, is stored in a 2,000-gallon tank.

A leak in a valve of one of the out-of-service diesel tanks occurred around 1983, resulting in a spill outside of the containment wall. A portion of the spill flowed along the drainage ditch located north of the refining area. The contaminated soil was excavated and the tanks were emptied. Although documentation of the spill is not available, the soil cleanup was reportedly conducted under state supervision.

Elevated concentrations of lead have been detected in surface and subsurface (less than four feet below ground surface) soils at the site. Low levels of lead and arsenic have been detected in groundwater samples collected from the site. RMC has developed a RCRA Facility Investigation Work Plan to define the nature and extent of releases of site-related contaminants at the site.

The RFI activities will include:

- evaluation of the existing monitoring well network;
- groundwater sampling using the existing network;
- surface and subsurface soil sampling, on and off-site;
- surface and subsurface sampling inside of the buildings; and
- sediment sampling of the surface impoundment and former drainage channels.

As required by the Consent Decree, the RFI Work Plan provides a more detailed description of the Site history: ownership and operational; setting: physiographic, topographic, ecological, local geology and hydrology; and surrounding land use. A discussion about the nature and extent of contamination is provided in more detail in the RFI Work Plan Section 4.0. This document will serve as the Quality Assurance Project Plan for the site monitoring data collection activities.

1.3 SAMPLING PARAMETERS

Based on past sampling data and as stated in the Consent Decree, the primary constituents of concern at the site are lead and cadmium. Groundwater, soil boring, dust, and sediment samples will be collected for analysis for cadmium and lead. Additionally, antimony and arsenic will be analyzed in groundwater samples collected at the site. Sampling parameters quantitation limits are listed on Table 1.1.

In addition, indicator parameters such as temperature, pH, redox potential, dissolved oxygen, turbidity, and specific conductance will be monitored in the field during well purging (for monitoring wells) and at the time of sample acquisition to assure that the well has been adequately purged and that the groundwater is a representative sample from the aquifer. No field parameters will be collected during soil, sediment or dust collection.

1.4 SAMPLING LOCATIONS

Maps showing the proposed soil, sediment, and dust/subsurface sampling locations are provided on Figures 5.1, 5.2 and 5.3 of the RFI Work Plan. These locations are proposed and depending on the nature of encountered field conditions, sampling locations may be changed. The On-site Principle Investigator will be responsible for making such decisions. Locations of the monitoring wells to be sampled are indicated on Figure 1-2 of the RFI Work Plan. The rational for the selected sampling locations are fully described in Sections 5.2, 5.3, 5.4 and 5.5 of the RFI Work Plan.

1.5 PROJECT SCHEDULE

The estimated Project Schedule shown on Figure 7-1 of the Closure Work Plan indicates the Closure activities will be conducted in a sequence of progressive work tasks. The Closure Work Plan and attachments delivery, review, and approval by USEPA and IDEM comprise the first task.

TABLE 1.1
REFINED METALS SITE PROJECT ANALYTE LIST

Constituent	Matrix	Human Health Data Quality Level[1]	Ecological Data Quality Level[2]	Reporting Limit
Antimony	aqueous	15 ug/l	Non Applicable	10 ug/l
Arsenic	aqueous	0.045 ug/l*	Non Applicable	1 ug/l
Cadmium	aqueous	18 ug/l	Non Applicable	0.2 ug/l
Cadmium	soil	8 mg/kg	181 ug/kg	0.5 mg/kg
Cadmium	sediment	Non Applicable	596 ug/kg	0.5 mg/kg
Cadmium	dust	Non Applicable	Not Applicable	0.5 mg/kg
Lead	aqueous	4 ug/l	Non Applicable	1 ug/l
Lead	soil	400 mg/kg	450 ug/kg	0.7 mg/kg
Lead	sediment	Non Applicable	31000 ug/kg	0.7 mg/kg
Lead	dust	Non Applicable	Not Applicable	0.7 mg/kg

* - For these parameters, analytical sensitivity is inadequate to meet target decision levels. Therefore, for risk assessment purposes, non-detect data shall be considered as equal to one-half the reporting limit.

1. EPA Soil Screening Guidance: Technical Background Document (OSWER Publication 9355.4- 17A; EPA/540/R-95/128, May 1996) or Region 9 Preliminary Remediation Goals, August 1996.

2. Region 5 Ecological Data Quality Levels.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

Quality assurance/quality control procedures presented in this QAPP will be strictly adhered to in order to generate data of known quality. The Refined Metals Corporation has selected Advanced GeoServices Corp., Chadds Ford, Pennsylvania to be responsible for coordinating sampling and analyses activities and validating data received from the laboratory. TriMatrix Laboratories, Grand Rapids, Michigan, will conduct the chemical analyses of the samples. This Laboratory possesses all credentials to do this work; qualifications and standard operating procedures are provided as Attachments A and B to this QAPP.

While all personnel involved in the investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specific responsibilities. The key individuals who are responsible for the overall coordination of efforts to be conducted, as well as the collection, validation and interpretation of the data generated during this project are identified in the following sections. Lines of authority specific to this investigation are presented in Figure 2-1. The figure includes all individuals discussed below.

2.1 MANAGEMENT RESPONSIBILITIES

2.1.1 Indiana DEM

Remedial Project Manager - Rebecca Eifert

Responsibilities of the IDEM Remedial Project Manager include:

- Overseeing implementation of the administrative order;
- Providing technical review and approval of all plans and data submitted as part of this investigation; and
- Coordinating site monitoring activities with RMC Project Manager

2.1.2 Refined Metals Corporation

Project Manager - Matthew Love

Responsibilities of RMC Project Manager include:

- Overseeing and coordinating all project activities on behalf of the Refined Metals Corporation; and
- Representing the Refined Metals Corporation in all project activities, technical and administrative matters with EPA and IDEM.

2.1.3 Advanced GeoServices Corp.

Project Manager - Paul G. Stratman, P.E.

Responsibilities of the AGC Project Manager include:

- Managing and coordinating site monitoring;
- Reviewing information obtained during the RFI;
- Initiating any RFI Work Plan or QAPP modifications;
- Providing in-house technical support for evaluating and organizing field data; and
- Providing input to the Task Managers on technical direction.

Task Managers - Edie M. Gair, P.G. and Stephen W. Kirschner, P.E.

Responsibilities of the AGC Task Managers include:

- Managing and coordinating the tasks of the Principle Investigator and technical staff personnel;
- Reviewing information obtained during the RFI; and

- Preparation of baseline plans and for the performance of work elements that comprise this project.

2.2 QUALITY ASSURANCE RESPONSIBILITIES

Advanced GeoServices Corp.

Quality Assurance (QA) Manager - Denise McGuire

Responsibilities of the AGC QA Manager include:

- Conducting at a minimum one field performance audit;
- Performing data validation and assessment of the analytical data generated during the RFI;
- Communicating analytical deficiencies found during data validation to the Project and Tasks' Managers to initiate corrective action;
- Preparing data validation reports and tabulation of analytical data; and
- Communicating with the laboratory for data deliverables and any problems with the data reported.

Quality Assurance Scientists

AGC Quality Assurance Scientists will be utilized to review chain-of custodies, validate data, construct data summary tables, and perform data entry. The QA Scientists will report to the QA Manager.

2.3 LABORATORY RESPONSIBILITIES

TriMatrix Laboratories, Inc.

Laboratory Operations Manager - Douglas E. Kriscunas

The Laboratory Operations Manager's responsibilities include:

- Liaison with sampling firm's Project Manager, Quality Assurance Manager, and laboratory technical staff;
- Production and efficiency of all departments including QA/QC;
- Recommendations of appropriate corrective action procedures to the QA Manager;
- Identification and supervision of appropriate and necessary support personnel; and
- Oversees final analytical results.

Laboratory Program Manager - Gary Wood

The responsibilities of the Laboratory Program Manager include:

- Coordinates laboratory analyses;
- Supervises in-house chain-of-custody;
- Oversees data review and data assessment;
- Oversees preparation of analytical reports; and
- Approves final analytical reports prior to submittal to the Client.

Laboratory Quality Assurance Supervisor (LQAS) - Rick D. Wilburn

Responsibilities of the LQAS include:

- Oversees QA/QC documentation;
- Inspecting and verifying laboratory QA/QC records and results;
- Implementing all laboratory QA/QC procedures contained in the QAPP;
- Overseeing corrective actions as required; and
- Conducting internal system and performance audits and inspection of analytical procedures.

Laboratory Sample Custodian - Keith Banchoff

The Sample Custodian's responsibilities include:

- Providing sample bottles;
- Receiving and inspecting the incoming sample bottles;
- Recording the condition of the incoming sample containers;
- Verifying chain-of-custody and it's correctness;
- Notifying Laboratory Program Manager of sample receipt and inspection;
- Assigning an unique identification number and customer number and enters each into the sample receiving log; and
- Controlling and monitoring access/storage of samples.

Laboratory Technical Staff

The technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the Laboratory Program Manager.

2.4 FIELD RESPONSIBILITIES

Advanced GeoServices, Corp.
On-Site Principle Investigator (PI) - Eric Stanke

The PI's responsibilities include:

- Providing full time field representation during field data collection activities;
- Collecting and reporting raw data;
- Overseeing any site contractors and other field personnel to ensure adherence to the RFI Work Plan and QAPP; and
- Ensuring the appropriate QC samples are collected.

Field Technical Staff

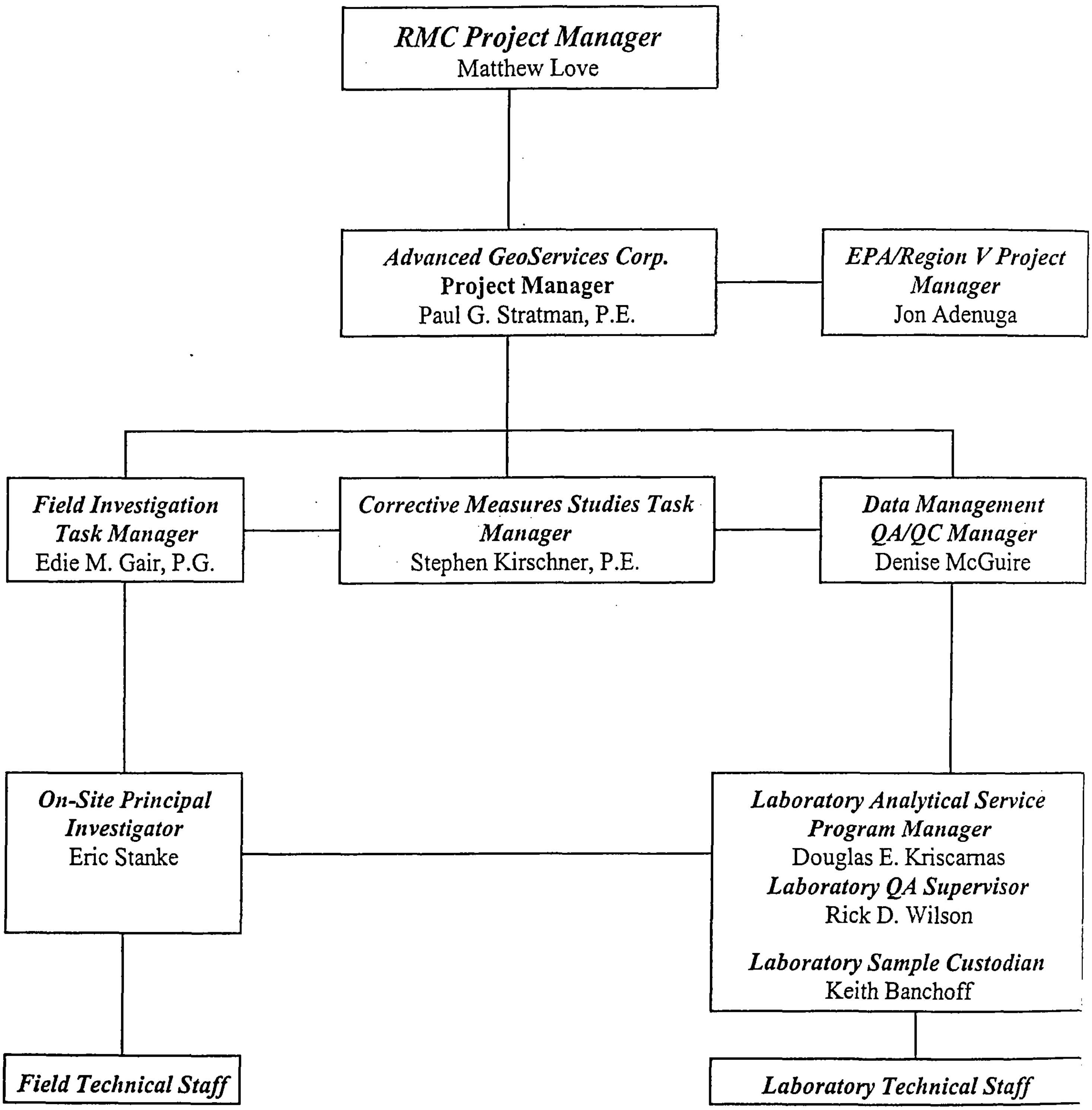
The technical staff for this project will be drawn from AGC's pool of corporate resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

2.5 TRAINING REQUIREMENTS

All personnel performing on-site activities are 40 hour OSHA 1910.120 trained. These individuals include:

Paul Stratman, P. E
Edie M. Gair, P.G.
Stephen W. Kirschner, P. E.
Denise McGuire
Eric Stanke
AGC Field Technical Staff

FIGURE 2-1
PROJECT ORGANIZATION CHART
REFINED METALS CORPORATION
RCRA FACILITY INVESTIGATION



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3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

Data Quality Objectives (DQOs) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision making process. Separate DQOs are designed for field sampling and laboratory analysis so that clear distinctions between any problems found in the system can be isolated with respect to cause. Conversely, the DQOs are also designed to provide an indication of the variability of the overall system. The overall quality assurance objective is to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data and to provide results which are legally defensible in a court of law. To achieve this, specific data requirements such as detection limits, criteria for precision and accuracy, sample representativeness, data comparability and data completeness (PARCC) are specified below. The DQOs for the RMC site are presented in Table 3.1.

3.1 PRECISION

Precision measures the reproducibility of measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average value. Precision is usually stated in terms of relative percent difference (RPD) or relative standard deviation (RSD). Measurement of precision is dependent upon sampling technique and analytical method. For inorganic analyses, field duplicate and laboratory duplicate samples will be used to measure precision for project samples. Both sampling and analysis will be as consistent as possible. For a pair of measurements, RPD will be used to evaluate precision. For a series of measurements, RSD will be used to evaluate precision. The total precision of a series of measurements can be related by the additive nature of the variances. Equations for RPD and RSD are presented in Section 12.1 of this QAPP. Precision control can be found on Table 3.2 and also in the applicable SOPs.

3.2 ACCURACY

Accuracy is defined as the degree of agreement of a measurement or average of measurements with an accepted reference value. Accuracy measures the bias in a measurement system which may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are:

- laboratory error;
- sampling inconsistency;
- field and/or laboratory contamination;
- handling;
- matrix interference; and
- preservation.

Laboratory blanks, field blanks and equipment blanks, as well as matrix spike (ms) samples and laboratory fortified blank samples , will be used to measure accuracy for project samples. The field component of accuracy will be negligible if the sampling, preservation, and handling techniques described in this QAPP are followed. Accuracy in laboratory methods and procedures will be evaluated by use of calibration and calibration verification procedures, and instrument performance solutions at the frequency specified in the USEPA "Test Methods for Evaluating Solid Waste Physical/Chemical Methods", November 1986, SW-846 3rd edition (SW-846) Update III. All parameters of concern are included in the matrix spiking solution for the matrix spike samples and laboratory fortified blank samples. Accuracy is calculated using the equation presented in Section 12.2 of this QAPP and accuracy control limits are given in Table 3.2.

3.3 DATA REPRESENTATIVENESS

Representativeness expresses the degree to which sample data represent the characteristics of the environment from which they are collected. Samples that are considered representative are properly collected to accurately characterize the contamination at a sample location. Therefore, the samples will be collected in a standardized method. Representativeness will be measured by using the field methods (e.g., sampling, handling, and preserving) in accordance with NEIC Policies and Procedures Manual and analytical methods in accordance with SW-846 methodologies. Representativeness will also be measured by the collection of field duplicates. Comparison of the analytical results from field duplicates will provide a direct measure of individual sample representativeness.

3.4 DATA COMPLETENESS

Completeness is defined as the percentage of data that is judged to be valid to achieve the objectives of the investigation compared to the total amount of data. Data gaps will be continuously addressed when/if they occur by systematic resampling, as needed. Deficiencies in the data may be due to sampling techniques, or poor accuracy, precision, and laboratory error. While deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. The level of completeness, with respect to usable data, will be measured during the data assessment process by comparing the total number of data points to the number of data points determined to be usable. A usability criteria of greater than 90 percent has been set for this project. The equation used for completeness is presented in Section 12.3 of this QAPP.

3.5 DATA COMPARABILITY

Comparability expresses the confidence with which one data set can be compared with another data set from a different phase or from a different program. Comparability involves a composite of the above parameters as well as design factors such as sampling and analytical protocols. Data comparability will be controlled through sample collection, methodology, analytical methodology and data reporting.

3.6 SENSITIVITY

All analyses will be performed using USEPA approved methods. The quantitation limits are those listed in the referenced method with allowance for dilutions. Specific QLs are highly matrix-dependent and may not always be achievable. See Table 1.1 and 3.3 for parameters to be analyzed and the corresponding DQO QLs, DLs and LOQs.

3.7 PROCEDURES FOR MONITORING PARCC PARAMETERS

PARCC parameters will be monitored through the submission and analyses of various types of field and laboratory QC samples. These will include appropriate field blanks, equipment blanks, laboratory method blanks, field duplicates or replicates, matrix spikes, matrix spike duplicates, instrument performance solutions, and a careful examination of all calibration and check standards.

- Field blanks and equipment blank consisting of distilled water will be submitted to the laboratory to provide the means to assess the quality of the data resulting from the field sampling program.
- Field blank samples are analyzed to check the procedural contamination at the facility which may cause sample contamination.
- Equipment blank samples are analyzed to check the decontamination procedural for field equipment which may attribute to cross contamination.
- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory practices.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility.

- MS/MSDs are performed to provide information about the effect of the sample matrix on the digestion and measurement methodology. MS/MSD pairs also check the analytical reproducibility.
- Instrument performance solutions, calibration and check standards are analyzed to assess the capability of the laboratory to perform the specific methods.

The frequency by which the field and laboratory QC samples will be prepared and submitted is specified in Section 8.0 of this QAPP. Table 3.4 summarizes the type and frequency of QC samples to be performed during this investigation. Sampling procedures for blanks and field duplicates are provided in Section 8.1.1 and 8.1.2.

3.8 PARCC OBJECTIVES

PARCC objectives have been developed for the analysis of groundwater, dust, soil, and sediment samples for the metals parameter analyses. The PARCC objectives are based on analytical methods, historical data and published guidelines/criteria. PARCC data quality objectives are summarized on Tables 3.1 and 3.2.

All off-site analysis will be used to develop definitive data using rigorous, approved, EPA reference methods.

3.9 DECISION RULE OBJECTIVES

A Decision Rule is a statement which allows for a course of action or non-action to be taken, based on assumptions made to draw out and test its logical or empirical consequences. The decision rule objectives for this investigation address the identification of action levels and development of if/then statements defining conditions that would cause the decision maker to chose among alterative actions. The decision rules associated with this investigation are that if any site-related constituents are identified above human health or ecological target levels in any of the monitoring wells or soils then the data will be used to define the extent of contamination or map the plume boundaries and all data generated will be subjected to a baseline human health risk assessment and preliminary ecological risk assessment. Decision rules will be determined by the following:

- Sampling of the groundwater will not be performed until specific field parameters (i.e. redox potential, pH, specific conductance and dissolved oxygen) stabilize.

- In order to determine whether the existing monitoring well network is sufficient to detect a release to groundwater, two quarterly groundwater sampling events will be conducted.

- To fully determine the extent of site-related constituents in soil, grab samples will be taken at two depth interval within the arbitrary grid shown on Figure 5-1 of the RFI Work Plan and from soil piles on the site.

- Interior sampling will be performed to characterize the floor material and determine the extent of site-related constituent contamination beneath the Material Storage Building.

- Collection of composite sediment samples in the former drainage channels and lined lagoon to address depositional environments at the site.

As more information from this investigation is gathered, the planing team will use the decision rule(s) for this site to statistically set the acceptable level of confidence in the data or the amount of uncertainty needed to optimize the design of the data collection.

TABLE 3.4
REFINED METALS SITE
SAMPLING AND ANALYSIS PROGRAM SUMMARY

Sample Location	Matrix	Parameters	Number of Samples	Field Duplicate	Matrix Spike	Blank[1]	Total Number of Samples[2]
Monitoring Wells	Groundwater	Qualitative Screening with OVA	NA	-	-	-	-
		Turbidity	NA	-	-	-	-
		pH	NA	-	-	-	-
		Redox potential	NA	-	-	-	-
		Specific Conductance	NA	-	-	-	-
		Temperature	NA	-	-	-	-
		Metals (total)[3]	NA	-	-	-	-
		Metals (dissolved)[3]	NA	-	-	-	-
Outdoor Waste Piles	Soil	Metals[5]	252	26	26	25	329
NE of Production Area Soil Piles	Soil	Metals[5]	NA	-	-	-	-
Off-site Soils	Soil	Metals[5]	NA	-	-	-	-

TABLE 3.4
REFINED METALS SITE
SAMPLING AND ANALYSIS PROGRAM SUMMARY
(Continued)

Sample Location	Matrix	Parameter	Number of Samples	Field Duplicate	Matrix Spike	Blank[1]	Total Number of Samples[2]
Material Storage Building	Dust	Metals[5]	3	1	2	1	7
Material Storage Building	Soil	Metals[5]	78	8	8	3	97
Lined Lagoon	Sediment	Metals[5]	4	1	2	2	9

Notes
1 Blank total includes estimated number of field and equipment blanks.
2 Total number samples per event.
3 Metals include; antimony, arsenic, cadmium, and lead.
4 This number reflects the fewest amount of samples to be taken.
5 Metals include; cadmium and lead.

TABLE 3.4
REFINED METALS SITE
SAMPLING AND ANALYSIS PROGRAM SUMMARY
(Continued)

Sample Location	Matrix	Parameter	Number of Samples	Field Duplicate	Matrix Spike	Blank[1]	Total Number of Samples[2]
Material Storage Building	Dust	Metals[5]	3	1	2	1	7
Material Storage Building	Soil	Metals[5]	78	8	8	3	97
Lined Lagoon	Sediment	Metals[5]	4	1	2	2	9

Notes
1 Blank total includes estimated number of field and equipment blanks.
2 Total number samples per event.
3 Metals include; antimony, arsenic, cadmium, and lead.
4 This number reflects the fewest amount of samples to be taken.
5 Metals include; cadmium and lead.

TABLE 3.4
REFINED METALS SITE
SAMPLING AND ANALYSIS PROGRAM SUMMARY

Sample Location	Matrix	Parameters	Number of Samples	Field Duplicate	Matrix Spike	Blank[1]	Total Number of Samples[2]
Monitoring Wells	Groundwater	Qualitative Screening with OVA Turbidity pH Redox potential Specific Conductance Temperature Metals (total)[3] Metals (dissolved)[3]	NA NA NA NA NA NA NA NA	- - - - - - - -	- - - - - - - -	- - - - - - - -	- - - - - - - -
Outdoor Waste Piles	Soil	Metals[5]	252	26	26	25	329
NE of Production Area Soil Piles	Soil	Metals[5]	NA	-	-	-	-
Off-site Soils	Soil	Metals[5]	NA	-	-	-	-

TABLE 3.4
REFINED METALS SITE
SAMPLING AND ANALYSIS PROGRAM SUMMARY
(Continued)

Sample Location	Matrix	Parameter	Number of Samples	Field Duplicate	Matrix Spike	Blank[1]	Total Number of Samples[2]
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Material Storage Building	Soil	Metals[5]	78	8	8	3	97
Lined Lagoon	Sediment	Metals[5]	4	1	2	2	9

Notes
1 Blank total includes estimated number of field and equipment blanks.
2 Total number samples per event.
3 Metals include; antimony, arsenic, cadmium, and lead.
4 This number reflects the fewest amount of samples to be taken.
5 Metals include; cadmium and lead.

TABLE 3.4
REFINED METALS SITE
SAMPLING AND ANALYSIS PROGRAM SUMMARY
(Continued)

Sample Location	Matrix	Parameter	Number of Samples	Field Duplicate	Matrix Spike	Blank[1]	Total Number of Samples[2]
Material Storage Building	Dust	Metals[5]	3	1	2	1	7
Material Storage Building	Soil	Metals[5]	78	8	8	3	97
Lined Lagoon	Sediment	Metals[5]	4	1	2	2	9

Notes
1 Blank total includes estimated number of field and equipment blanks.
2 Total number samples per event.
3 Metals include; antimony, arsenic, cadmium, and lead.
4 This number reflects the fewest amount of samples to be taken.
5 Metals include; cadmium and lead.

4.0 SAMPLING PROCEDURES

Groundwater, soil, dust and sediment sampling is required to monitor the presence/absence and degree of metal constituents in these media at the Site. Specific sampling procedures are set forth in this section to meet the QA objectives outlined in Section 3.0 of this QAPP. The Site sampling Scope of Work (Section 5.0 of the RFI Work Plan) must be used concurrently with this QAPP during field sampling.

4.1 GROUNDWATER SAMPLING

Two groundwater sampling events will be conducted at five on-site monitoring wells.

4.1.1 Sampling Procedures

Detailed sampling procedures are provided in Section 5.2.3 of the RFI Work Plan and SOPs in Attachment B and include:

- Low-flow pump purging and sampling; and
- Field parameter measurements.

Samples will be collected directly from the low-flow pump discharge line into laboratory provided sample containers (for total metal analyses) or dedicated disposable filter units and then into laboratory prepared bottles (for dissolved metal analyses). If sufficient volume is not available to sample any well with the low-flow pump, a sample will be collected using a disposable Teflon® bailer. Field parameter analyses will include, temperature, pH, specific conductance, redox potential, dissolved oxygen and turbidity, which will be measured using flow-through cells during well purging to determine if the well was adequately purged prior to sample collection. Field blanks, equipment blanks, field duplicates, and matrix spike/matrix spike duplicate samples will be obtained as described in Section 8.1.

4.1.2 Sample Designation/Identification

Each sample will be assigned a sample designation according to a pre-determined numbering system. The sample designation at a minimum will include in abbreviated form: type of sample (i.e., MW) and a sample number. The sample designation will be written in indelible ink on an identification tag and attached to the sample container. Sample tags will also contain the items noted in Section 5.1.2.

4.1.3 Analytical Parameters

All samples collected will be analyzed for the parameters listed on Table 4.1. These include total and dissolved antimony, arsenic, cadmium and lead. Table 4.1 lists the associated analytical methods, sample preservatives, sample container requirements, and holding times.

4.2 SOIL SAMPLING

Soil samples will be collected from the 57 locations. The soil sample locations are identified in Section 5.3 of the RFI Work Plan.

4.2.1 Sampling Procedures

Surface grab soil samples will be collected using a dedicated disposable plastic trowel while subsurface grab soil samples will be collected using a hand auger. The soil sample will be removed from the hand auger using a dedicated disposable plastic scoop. The samples will be homogenized in a decontaminated stainless steel bowl and then placed directly into the laboratory supplied sample containers. Sampling procedures are provided in detail in Section 5.3 of the RFI Work Plan and SOPs provided in Attachment B.

4.2.2 Sample Designation/Identification

Each sample will be assigned a sample designation according to a pre-determined numbering system. The sample designation at a minimum will include in abbreviated form: type of sample (i.e., S) and a sample number. The sample designation will be written in indelible ink on an identification tag and attached to the sample container. Sample tags will also contain the items noted in Section 5.1.2.

4.2.3 Analytical Parameters

All samples collected will be analyzed for the parameters listed on Table 4.1, which include cadmium and lead. Table 4.1 lists the associated analytical methods, sample preservatives, sample container requirements, and holding times.

4.3 INTERIOR SAMPLING

Floor dust samples will be collected from three locations on the floor within the Materials Storage Building and soil samples will be collected from beneath the floor slab inside the Materials Storage Building. The dust and soil sample locations are identified in Section 5.4 of the RFI Work Plan.

4.3.1 Sampling Procedures

The dust samples will be collected using dedicated disposable scoops. The soil samples will be collected using a hand auger. The soil sample will be removed from the hand auger using a dedicated disposable plastic scoop. The samples will be homogenized in a decontaminated stainless steel bowls and then placed directly into the laboratory supplied sample containers. Detailed sampling procedures are provided in Section 5.4 of the RFI Work Plan and SOPs provided in Attachment B.

4.3.2 Sample Designation/Identification

Each sample will be assigned a sample designation according to a pre-determined numbering system. The sample designation at a minimum will include in abbreviated form: type of sample (i.e., D, S) and a sample number. The sample designation will be written in indelible ink on an identification tag and attached to the sample container. Sample tags will also contain the items noted in Section 5.1.2.

4.3.3 Analytical Parameters

All samples collected will be analyzed for the parameters listed on Table 4.1, which include cadmium and lead. Table 4.1 lists the associated analytical methods, sample preservatives, sample container requirements, and holding times.

4.4 SEDIMENT SAMPLING

Composite sediment samples will be collected from two locations within the concrete and geomembrane lined surface impoundment. Sediment samples will also be collected from two former drainage channels. Figure 5-3 of the RFI Work Plan shows the proposed sediment sampling locations.

4.4.1 Sampling Procedures

Composite sediment samples will be collected over the vertical profile of sediment at each sample location within the concrete and geomembrane lined surface impoundment. Sample depths will be measured and samples will be collected using a decontaminated shovel or disposable scoop so not to jeopardize the integrity of the liner. The sediment samples collected from the drainage channels will be collected at two depth intervals using a decontaminated hand auger. Each sediment sample collected will be homogenized, and placed into laboratory supplied containers and sealed. Detailed sampling procedures are provided in Section 5.5 of the RFI Work Plan and SOPs found in Attachment B.

4.4.2 Sample Designation/Identification

Each sample will be assigned a sample designation according to a pre-determined numbering system. The sample designation at a minimum will include in abbreviated form: type of sample (i.e., SED) and a sample number. The sample designation will be written in indelible ink on an identification tag and attached to the sample container. Sample tags will also contain the items noted in Section 5.1.2.

4.4.3 Analytical Parameters

Samples collected will be analyzed for the parameters listed on Table 4.1, which include cadmium and lead. Table 4.1 lists the associated analytical methods, sample preservatives, sample container requirements, and holding times.

4.5 FIELD EQUIPMENT DECONTAMINATION

To prevent possible contamination from sampling equipment, all non-dedicated sampling devices will be decontaminated. Non-dedicated equipment are the low flow pump, stainless steel bailers, mixing bowls, hand augers and shovels. Sampling equipment will be constructed of inert material (e.g., stainless steel, Teflon®). For non-dedicated equipment, field decontamination will be performed prior to its initial use, between sampling locations and between actual samples when more than one sample is to be collected at a given location. Decontamination is not required when dedicated, disposable bailers, trowels or scoops are used. All decontamination and subsequent use of decontaminated equipment will be documented in a field logbook.

All non-dedicated sampling equipment will be decontaminated according to the following procedure:

1. Wash equipment thoroughly with a low phosphate detergent (Alconox) and water using a brush to remove any particulate matter or surface film.
2. Rinse equipment with distilled water.
3. Rinse with diluted nitric acid.

4. Triple rinse with distilled water.
5. Air dry equipment.
6. Wrap equipment in a clean plastic sleeve or in aluminum foil if not used immediately.

Spent nitric acid will be contained in a bucket and placed in drums.

4.6 SAMPLE HANDLING

4.6.1 Sample Containers

Sample containers will be provided to the sampling team by the laboratory sample custodian. All sample containers used in the course of this investigation will be new containers, pre-cleaned and certified as Level II or higher by I- CHEM Inc. Certificates of analysis are available from I-CHEM upon request. All bottles will be prepared by the laboratory with the appropriate preservative. After sample collection, containers will be labeled as specified in Section 5.1.2.

4.6.2 Sample Preservation and Holding Times

The laboratory will provide appropriately prepared sample containers for this project. The sample containers will be I-Chem bottles or the equivalent which are cleaned and preserved for the specific analysis. Aqueous samples for metals analyses will be preserved with nitric acid to pH<2. Samples for dissolved metals will be field filtered prior to preservation. No acid preservation is required for the collection and analysis of soil, dust, or sediment samples. All samples will be placed on ice and maintained at a temperature of approximately 4 degrees Celsius from the time of collection to the time of analysis.

TABLE 4.1
REFINED METALS SITE
PARAMETER TABLE

Parameter	Matrix	Method	Container Type	Preservative	Holding Time
Antimony, Arsenic, Cadmium and Lead[1]	Aqueous	EPA SW-846[2] 3005A/3010A/ 6020	1 liter plastic	HNO_3 to pH<2 Cool 4°C	180 days
pH, Temperature, Redox Potential, Dissolved Oxygen, Specific Conductance	Aqueous	Manufacturer's Instructions	NA	NA	Analyze immediately
Cadmium and Lead	Soil/Sediment	EPA SW-846[2] 3050B/6010B	125 ml. amber glass	Cool 4°C	180 days
Cadmium and Lead	Dust	EPA SW-846[2] 3050B/6010B	125 ml. amber glass	Cool 4°C	180 days

Notes:

1 Includes total and dissolved metals. Dissolved metals will be filtered prior to preservation.
2 USEPA "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", November 1986, SW-846, Third Edition Update III.

NA - Not Applicable.

5.0 SAMPLE CUSTODY/SAMPLE CONTROL

A sample is physical evidence collected from the project site. Due to the evidential nature of the data generated from sampling, sample custody must be traceable from the time the empty sample containers are prepared by the container supplier through the reporting of the results of the analyses. As an essential part of project management, sample control procedures have been established to ensure sample integrity. All sample containers and samples will be maintained under strict custody procedures throughout the investigation. Sample custody is addressed in three parts: field sample collection, laboratory analysis and final evidence files.

A sample, sample container, or evidence file will be considered under custody if:

- the item is in actual possession of a person; or
- the item is in the view of the person, after being in actual possession of the person; or
- the item was in the person's actual physical possession but is now locked up or sealed in a tamper-proof manner; or
- the item is placed in a designated secured restricted area.

5.1 FIELD CUSTODY PROCEDURES

Sample custody for samples collected during this investigation will be maintained by the PI or field personnel collecting the samples. The PI or field personnel is responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory or archived.

5.1.1 Field Data Documentation/Field Logs

A system of logging all pertinent data collected during sampling operations will be maintained using dedicated bound field logbooks. Each page will be numbered, dated and initialed by the person making the entry. All entries will be made in indelible ink. Incorrect entries will be crossed out with a single line and verified with the recorder's initials. At the completion of the day, if a page is not complete, a diagonal line will be drawn through the remainder of the page with the notetaker's signature at the bottom.

All sample locations will be recorded and referenced to the site map so that each location is permanently established. Samples will be tagged with all pertinent site information at the time of sampling. Section 5.1.2 describes sample identification. Pertinent site information to be supplied in the field logbook for each task is listed below:

- Signature of notetaker;
- Name and location of investigation;
- Date and time of arrival and departure;
- Names of all personnel on-site and their affiliation;
- Purpose of the visit/description of field activity;
- All field instruments used, date and time of calibration and calibration checks, method of calibration, standards used;
- All field measurement results;
- Date, time, and location of all sampling points;
- Method of sample collection;
- Any factors which could affect sample integrity;
- Name of sampler;
- Sample identification, sample description, sample preservation;
- Documentation of all conversations with the client, agency personnel, field decisions and approval; and
- Weather conditions.

Field logbooks should contain only factual information entered as real-time notes which will enable the user to recreate events on-site. They are a part of the project file and are admissible as evidence in litigation. In addition, chain-of-custody records will be prepared and kept as part of the field records.

5.1.2 Sample Identification

All sample bottles will be identified by the use of sample tags with sample identification. Each sample tag will be labeled by the sampler to avoid any possibility of sample misidentification and attached to the sample container with a wire around the container neck through a reinforced hole in the tag. Indelible ink shall be used to complete sample tags. Each sample tag will be labeled at the time of collection with, at a minimum, the following information:

- Site specific project number and name;
- Date and time (military) of sample collection;
- Sample designation (location), note here if the sample is a QC sample or to be used for QC analysis;
- Whether sample is a grab or composite;
- Presence of a preservative;
- Field representative(s) collecting the sample (Sampler); and
- Analyses requested.

The PI or field sampler will maintain custody of samples following the procedures outlined in the following section until samples are properly relinquished to the laboratory or to a common carrier for delivery to the laboratory. Once at the laboratory, each sample will be assigned a unique laboratory identification number that will be used for analysis assignment, sample tracking, and data reporting while the samples are at the laboratory.

5.1.3 Chain-of-Custody Procedures

The following Chain-of-Custody procedures will be used for this project:

- New, certified clean sample containers will be prepared and relinquished by the laboratory on a chain-of-custody record. The chain-of-custody record will be used for all samples collected to document the sample custody transfer from person to person.
- Any transfer of custody of containers or samples will be noted on the chain-of-custody record.
- Each sample collected for the project will be entered on the chain-of-custody record.
- The chain-of-custody will be completed as soon as possible after sample collection. The following information must be supplied to complete the chain-of-custody record:

  a. Site specific project name and number;
  b. Signature of samplers;
  c. For each sample, sampling station number, date and time (military) of collection, grab or composite sample designation, and brief description of the type of sample and sampling location;
  d. Number of sample containers per each sample location;
  e. Analysis required;
  f. Type of sample preservative;
  g. Signatures of individuals involved in sample transfer (i.e., relinquishing and accepting samples). Individuals receiving the samples shall sign, date, and note the time that they received the sample on the record; and
  h. Type of carrier service.

- The original chain-of-custody record will accompany the sample containers during transport to document their custody.
- If custody is relinquished through a common parcel carrier for delivery to the laboratory, the following protocol will be followed:

a. The original completed chain-of-custody record will be placed inside the shipping package; and

b. The shipping package will be sealed with tape and custody seals affixed. The seals will be placed on the package in such a manner that the package cannot be opened without breaking the seals. The seals will serve to document that the shipping container was not opened during the shipment through the common parcel carrier.

The chain-of-custody record is presented on Figure 5.1 of this QAPP.

5.1.4 Sample Shipment Procedures

At the end of the sampling day, all samples for chemical analysis will be packaged in shipping containers for shipment to the analytical laboratory using the following steps:

1. Check each sample bottle for a properly completed sample identification label.
2. Place sample bottles from each location in separate plastic bags, then seal.
3. Ship the samples in a large capacity (waterproof metal or equivalent strength plastic) cooler, or specific laboratory-prepared sample shipping container. Place packing material (asbestos-free vermiculite, perlite, or Styrofoam beads) on the bottom of the cooler to prevent sample bottle breakage.
4. Place sample bottles in the shipping container in a manner that they do not touch and will not touch during shipment. Secure with packing material as needed to fill void space.
5. Maintain all samples at approximately 4°C during shipment. Use ice or freezer packs to cool the samples.
6. Place the original chain-of-custody record in a plastic bag, seal, and tape it to the inside of the shipping container lid.
7. Retain the pink copy of the chain-of-custody for the QA Manager.
8. Tape cooler drain shut. Tape the cooler or shipping container closed at a minimum of two locations.

9. Place two signed and dated custody seals across each edge of the shipping container.
10. Attach completed shipping label to the top of the cooler.
11. Relinquish the cooler to the courier with the required signed and dated handbill.
12. Retain receipt of the handbill as part of the permanent documentation.

If the sample coolers are not shipped but instead picked up by the laboratory courier, step number 6 and 12 will be omitted and the chain-of-custody will be handed to and signed by the laboratory courier. The pink copy of the chain-of-custody will be maintained by the sampler and presented to the QA Manager.

5.2 LABORATORY SAMPLE CUSTODY PROCEDURES

Once the sample arrives at the laboratory, custody of the samples will be maintained by laboratory personnel. Upon receipt of the samples, the sample custody personnel will remove the chain-of-custody from the sealed cooler and sign and record the date and time on the chain-of-custody. The samples received will be verified to match those listed on the chain-of-custody. The laboratory will document and notify the Sampling Contractor's QA Manager immediately if any inconsistencies exist in the paperwork associated with the samples. The laboratory at a minimum will document the following stages of analysis: sample receipt, sample extraction/preparation, sample analysis, data reduction, and data reporting.

Samples will be given an unique laboratory identification number which is entered into the sample receiving log and the Laboratory Information Management System (LIMS). The analyst will enter the analytical data into the LIMS upon analysis completion and validation. The samples are placed into appropriate storage (refrigerators at 4°C) within an access controlled location. All samples are maintained under proper storage conditions for thirty days past the generation of the analytical report. The LIMS tracks the sample until completion of the report and invoice mailing. The data archived from the LIMS will be transferred to magnetic tape and retained for five years from the completion of sample analysis.

A chain-of-custody Sample Control Record is used as the documentation for the movement of chain-of-custody samples in and out of the access controlled storage. The analyst signs sample in and out each time a sample(s) is removed for any analysis. After all analyses are complete, the sample custodian files the form in the chain-of-custody project file. An example of the chain-of-custody Sample Control Record can be found on Figure 5.2.

5.3 FINAL EVIDENCE FILES

The final evidence file will be a central repository for all documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. AGC is the custodian of the evidence file and maintains the contents of evident files for the investigation at the AGC Chadds Ford office. The files will be maintained as mandated by the EPA and will be maintained for a minimum six years after the termination of the order. Prior to disposal, the EPA will be offered the evidence file contents. The final evidence file will contain at a minimum the following:

- Field logbooks
- Photographs
- Drawings
- Soil boring logs
- Laboratory data deliverables
- Data validation reports
- Progress reports
- Custody documentation

TriMatrix Laboratories, Inc.

5555 Glenwood Hills Parkway SE • PO Box 888692 • Grand Rapids, MI 49588-8692

Chain of Custody Record

COC No.
№ 27056

Project Manager	Project Name	No. of Containers	No's Correspond to Bottle Packing List		For Lab Use Only
Project No.	Sampler (Print)				Rack/Tray No:
	Sampler Signature				Lab Project #

Date Sampled	Time Sampled	Matrix*	Composite	Grab	Sample Identification	No. of Containers	Container Type	Analysis Required/Comments	Sample No.	Filtered Date/Time
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			

Relinquished By:	Date/Time	Received By:	Received to Lab By:	Date/Time	Logged in By:	Date/Time

TRIMATRIX LA ATORIES, INC. - GRR
CHAIN OF CUSTODY REPORT FOR AN ENTIRE SUBMITTAL

CLIENT: EARTH TECH-Grand Rapids Office PROJECT: Analytical Services

SUBMITTAL: January 16, 1996 Samples PROJECT: 33086-1

Parameter: IRON, TOTAL Method: ICP/EPA/WT Ref Cit: EPA-200.7/6010A Matrix: WATER

SAMPLE #	REMOVED BY: (SIGNATURE)	DATE & TIME REMOVED	RELINQUISHED BY: DATE & TIME	RECEIVED BY: DATE & TIME	DATE & TIME RETURNED
136055	David Johnson	1-17-96 8:00am			1-17-96 12:00pm
136056	DWJ				
136057	DWJ				
136058	DWJ				

6.0 CALIBRATION PROCEDURES AND FREQUENCY

In order to provide high quality data, it is essential for all field and laboratory equipment to be in satisfactory operating condition. Thus, routine equipment calibration and maintenance is required.

6.1 FIELD INSTRUMENT CALIBRATION

During groundwater sampling, field measurements including pH, temperature, redox potential, dissolved oxygen, specific conductance and turbidity will be taken. Field calibration procedures, at a minimum, will include the following:

- Calibration of field instruments will be performed by trained technicians prior to mobilization of equipment to the site. All instruments will be calibrated as specified by the manufacturer. Standard solutions will also be checked to determine stability and operating conditions. All results of field calibrations and measurements will be maintained in bound site-dedicated logbooks assigned to the specific instrument and/or field logbooks at least daily when the instrument is in use. The recorded calibration information will include date and time of calibration, standards used, corrective actions taken if necessary, and calibration results. Routine field equipment maintenance will be documented in bound logbooks which will be kept with the field instruments.

- pH meters will be calibrated according to manufacturer's instructions prior to each use and will, at a minimum, consist of two standard buffer solutions (4, 7, or 10) obtained from chemical supply houses. Additionally, two standard buffer solutions will be analyzed as verification checks after every 20 samples and after each use. The verification check results must agree within $\pm$ 0.05 pH standard units or recalibration and reanalysis of all samples since the last verification check sample is required.

- All field thermometers will be checked against a NIST or equivalent thermometer once a year. The temperature difference will be documented in a logbook and the field measurements will be adjusted accordingly. Temperature measurements will be recorded to ± 0.2° C.

- Dissolved oxygen meters are calibrated by a trained technician prior to use in the field using a 100 percent relative humidity chamber (air calibration method). A Winkler titration is performed to check the accuracy of the air calibration method. Dissolved oxygen meters will be calibrated in the field daily by the sampling personnel using the air calibration method.

- Specific conductance meters will be calibrated prior to each use using two potassium chloride solutions prepared by a qualified laboratory or chemical supplier. These solutions will bracket the levels of the samples. At a minimum, one of the solutions will be analyzed as a verification check after each sample location and at the end of the day. The verification check must be within ± 10% of the true value. If the verification check is not within 10% of the true value, recalibration of the instrument is required and the last sample must be reanalyzed.

- Turbidity meters will be calibrated daily prior to use by using a standard of known turbidity provided by the manufacturer.

- An OVA field screening instrument will be used to monitor the head space of each monitoring well prior to sampling. The OVA will be calibrated by a trained field technician with a certified gas (86.5 ppm methane in air) prior to mobilization of equipment to the Site. Daily calibrations on-site will be performed by the field sampling personnel. Initial calibration information will be recorded in field logbooks.

All calibration procedures performed will be documented in the field logbook and will include the date and time of calibration, name of the person performing the calibration, reference standards used, and the instrument readings.

6.2 LABORATORY INSTRUMENT CALIBRATION

For metal analysis, the samples will be prepared according to SW-846 Method 3005A, 3010A or 3050B, which are nitric acid digestion procedures. Prior to digestion, soil and sediment samples will be dried at 60°C then homogenized with particle size reduction. Metal parameters will then be analyzed for each digested sample in accordance with SW-846 Method 6010B (inductively coupled plasma) and 6020 (inductively couple plasma mass spectrometry). Initial calibrations will be performed and an instrument performance check solution will be analyzed prior to sample analysis. The linearity of the instrument will be checked by using a 3 point calibration with reference standards bracketing the expected measurements. Calibration checks and blanks will be analyzed after every 10 samples. Specific laboratory instrument calibration requirements are outlined in the laboratory SOP provided in Attachment B.

The laboratory maintains a sample logbook for each instrument. These logbooks contain the following information: instrument identification, date of calibration, analyst, calibration standards, and samples associated with these calibrations.

If equipment fails calibration or equipment malfunction is noted during calibration, the equipment is tagged and removed from service. The equipment is held out of service until repairs and successful calibration occur. All malfunctions, repairs and recalibrations are recorded in the appropriate instrument maintenance and calibration logs.

7.0 ANALYTICAL PROCEDURES

7.1 FIELD ANALYTICAL PROCEDURES

Temperature, Eh, dissolved oxygen, turbidity, pH and specific conductance measurements of samples will be performed to determine if a well has been adequately purged as described in Section 5.2 of the RFI Work Plan. All field measurements will be collected according to manufacturer's instructions and the SOPs provided in Attachment B.

7.2 LABORATORY ANALYTICAL PROCEDURES

All sample media will be analyzed by TriMatrix Laboratories, Inc. TriMatrix is located at:

5555 Glenwood Hills Parkway SE
Grand Rapids, Michigan 49588
Telecon (616) 975-4500
Facsimile (616) 942-7463

The laboratory will conduct the analyses in accordance with the specified methods in Table 3.3. Soil and sediment samples will be dried prior to digestion. Only the most updated U.S. EPA approved SW-846 methodology will be used. These methods have been selected because they are deemed sufficient to achieve the project data quality objectives. Standard Operating Procedures for the analyses are identified in Table 7.1 and are provided as attachments to this document.

The laboratory SOPs listed in Table 7.1 include a QA section which address the minimum QC requirements for analyses. All quality control samples identified in Section 8.0 will be analyzed as appropriate for each method. The quality control criteria as identified in the referenced U.S. EPA Methods must be met or appropriate action will be taken. This may include termination of analysis, reanalysis of samples, or accepting the data and acknowledging a level of uncertainty.

7.3 PROJECT TARGET COMPOUNDS AND LABORATORY DETECTION LIMITS

A complete listing of the project target compounds, quantitation limits and laboratory method detection limits is provide in Table 3.3.

7.4 ASSOCIATED QUALITY CONTROL SAMPLES

The laboratory SOPs listed in Table 7.1 include a QA section which addresses the minimum QC requirements for the analysis of specific analyte groups. All project target compounds will be added to the spiking solution, in compliance with project requirements. Section 8.0 of this QAPP contains a complete listing of the associated QC samples for every analyte group and matrix.

TABLE 7.1
REFINED METALS SITE
PROJECT ANALYTE LIST

Metal Parameters	Method [b]	Laboratory Standard Operating Procedure
Aqueous[a]		
Antimony, Arsenic, Cadmium & Lead	3005A/3010A	Procedure No. GR-01-121(Preparation)
Antimony, Arsenic, Cadmium & Lead	6020	Procedure No. GR-01-129(Analysis)
Soil/Sediment		
Cadmium & Lead	3050B	Procedure No. GR-01-103(Preparation)
Cadmium & Lead	6010B	Procedure No. GR-01-100(Analysis)
Dust		
Cadmium & Lead	3050B	Procedure No. GR-01-103(Preparation)
Cadmium & Lead	6010B	Procedure No. GR-01-100(Analysis)

NOTE:

a. Includes dissolved and total metals.

b. According to USEPA "Test Methods for Evaluating Solid Waste: Physical/Chemical Methods", November 1986, SW-846, Third Edition, Update III.

8.0 INTERNAL QUALITY CONTROL

Quality control and quality assurance procedures include both field and laboratory check samples and are designed to ensure and document the overall quality of the data. QA/QC checks detect potential problems at the source and, if necessary, trace the sample analytical pathways for introduction of contamination. The quality control data generated in the field will monitor sampling techniques, reproducibility, and cleanliness. Quality control data generated by the laboratory will monitor reproducibility (precision), cleanliness, and accuracy in analyzed samples. During data validation, QC check results are used to evaluate precision, accuracy, and representativeness of the overall sampling and analytical program.

8.1 FIELD QUALITY CONTROL/QUALITY ASSURANCE SAMPLES

The field quality control samples monitor the data quality as it is affected by the field procedures and conditions. Field QC samples are control samples that are introduced to the laboratory from the field. During field sampling efforts, different types of QA samples will be collected: field blanks, equipment blanks, field replicate and samples, matrix spike/matrix spike duplicate samples. The QC criteria for each field quality control sample are provided in Table 3.4. Validation guidelines stated in Section 9.2 will be used for the acceptance limits of the field QC samples. Each type of QA sample is described below.

8.1.1 Field Blanks

Field blanks are collected in the field by pouring demonstrated analyte-free water provided from the laboratory from one sample container into a preserved sample container identical to those provided for sample collection. One field blank will be collected for each sampling round. Field blanks will be analyzed for metals. Field blanks for dissolved metals will be filtered through a 0.45 μm filter prior to preservation.

8.1.2 Equipment Blanks

Equipment blanks are prepared in the field to ensure a sampling device (e.g., pump, bailer, bailer line) has been effectively cleaned. The sampling equipment is filled with deionized water or deionized water is pumped through the device, transferred to the laboratory supplied sample bottles, preserved if necessary, and sent to the laboratory for analyses with the site samples. If dedicated equipment is not used, one equipment blank will be submitted for metal analyses for every 10 samples per media collected. Equipment blanks for dissolved metals will be filtered through a 0.45 µm filter prior to preservation.

8.1.3 Field Duplicate Samples

Field duplicate samples consist of an actual sample taken in the field which has been split into two aliquots and put into two separate sampling containers. Aqueous samples will be obtained by alternately filling sample containers from the same sampling device for each parameter. When obtaining soil, dust, or sediment duplicate samples, homogenization of the sample aliquot prior to filling the sample containers will be performed to generate two equally representative samples. The samples will be transported to the laboratory and analyzed as two separate samples. The results will be used to assess laboratory accuracy and precision of sampling and analysis.

Each sample will be labeled with a unique sample number and submitted to the laboratory for the appropriate analyses. Field duplicate samples determine analytical precision and sample representativeness. One field duplicate sample will be collected for every 10 samples per media collected.

8.1.4 Matrix Spike/Matrix Spike Duplicate Samples

Matrix spike (MS) and matrix spike duplicate (MSD) samples will be submitted in association with metal analyses as further QC checks. MS and MSDs will be collected from the same location as the field sample and in the same manner.

Each sample will be labeled with the sample number as the original sample, designated as MS or MSD sample, and submitted to the laboratory for the appropriate analyses. MS/MSD samples determine accuracy by the recovery rates of the compounds added by the laboratory (all site related metal compounds will be included in the spiking solution). The MS/MSD samples also monitor any possible matrix effects specific to samples collected from the site and the extraction/digestion efficiency. In addition, the analysis of MS and MSD samples check precision by comparison of the two spike recoveries. One MS and MSD sample will be collected for every 20 samples per media collected and analyzed for metals (groundwater MS/MSD samples will be collected for both total and dissolved metals).

8.2 INTERNAL LABORATORY QUALITY CONTROL CHECK SAMPLES

All QC procedures employed by the laboratory will be, at a minimum, equivalent to those required in the specified analytical methods. Laboratory QC checks are accomplished through the analyses of laboratory blanks, matrix spike/matrix spike duplicates, calibration verifications, laboratory fortified blanks and performance evaluation samples. When internal quality control results fall outside method acceptance criteria, the data will be reported, and the analysis repeated, flagged or accepted according to the specified analytical methods. The following sections generally describe internal laboratory quality control check samples. Specifics are detailed in the laboratory Standard Operating Procedures provided in Attachment B.

8.2.1 Laboratory Blanks

Method/preparation blanks are generated within the laboratory during the processing of the actual samples. These blanks will be prepared using the same reagents and procedures and at the same time as the project samples are being analyzed. If contamination is found in the method blank, it indicates that similar contamination found in associated samples may have been introduced in the laboratory and not actually present in the samples themselves. Guidelines for accepting or rejecting data based on the level of contamination found in the blank are presented in the specified analytical method and laboratory SOPs.

A minimum of one method blank per 20 samples will be analyzed or, in the event that an analytical round consists of less than 20 samples, one method blank sample will be analyzed.

8.2.2 Instrument Blanks

Instrument blanks are prepared by the laboratory using deionized water for sample analysis. Instrument blanks are analyzed every ten samples to verify no cross contamination or baseline drifting has occurred. An instrument blank is generally analyzed after each calibration verification standard.

8.2.3 Matrix Spike/Matrix Spike Duplicates

Matrix spike analyses are performed in association with the sample metal analyses. Matrix spikes are prepared by placing a known quantity of selected target analytes into a second aliquot of an actual field sample (Section 9.1.4). All project target analytes will be included in the spiking solution. The spiking occurs prior to sample preparation and analysis. The matrix spike is then processed in a manner identical to the field sample. Recovery of each of the spiked compounds reflects the ability of the laboratory and method to accurately determine the quantity of that compound in that particular sample.

Matrix spike duplicates are identical to matrix spikes. Another aliquot of the field sample used for the MS is fortified with the same quantity of the spiking compounds and is processed in an identical manner. In addition to providing a measure of accuracy of the determination, the results for the MS/MSD pair provide a measure of precision of the determinations by assuring the availability of positive results for comparison.

Matrix spike and matrix spike duplicates will be analyzed at a frequency of one pair per sample delivery group of up to 20 samples per media collected.

8.2.4 Calibration Verifications

Initial calibration of the ICP and ICPMS will be completed prior to sample analysis following the specified analytical methods and laboratory SOPs. Additionally, continuing calibration standards will be analyzed at least every tenth sample for metal analysis. Recalibration is required if the continuing calibration standards do not meet U.S. EPA method criteria. Specific calibration standard procedures are outlined in the laboratory Standard Operating Procedures (Attachment B).

8.2.5 Laboratory Fortified Blank (LFB)

The LFB is prepared by the laboratory by adding analytes of known concentrations to DI water for aqueous metals analysis. Reference materials with known concentrations are digested concurrent with samples for solid metals analyses. The LFB is designed to assess the capability of the laboratory to perform the analytical methods. If the analytes present in the LFB are not recovered within the criteria defined in the specified analytical methods, the samples will be redigested and reanalyzed or data will be flagged.

8.2.6 Performance Evaluation Samples

Performance evaluation (PE) samples are of known composition which has been provided to the laboratory for analysis by either an agency or client. The laboratory results are compared to the actual values to evaluate the laboratory's performance. Performance evaluation sample analyses are performed on a regular basis as required for the laboratory's certifications. Some PE programs which TriMatrix participates in are USEPA Water Pollution Performance Evaluation Study, ASI National Performance Evaluation Study and USEPA Water Supply Study.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

All field data will be written in ink into bound field logbooks immediately after measurements are taken. If errors are made, the error will be crossed out with a single line, initialed and dated with the corrections written clearly adjacent to the original entry.

9.1.2 Laboratory Data Reduction Procedures

All analytical data will be permanent, complete and retrievable. The analyst will record the analytical data in notebooks along with other pertinent information such as the laboratory ID number. Each page of the notebook shall be signed and dated by the analyst. Periodic review of the notebooks will be performed by a supervisor prior to final data reporting. Upon analysis completion and laboratory validation, the analyst will enter the analytical data into the LIMS.

The laboratory will report sample results on analysis report forms and provide the information described in USEPA SW-846 for all analyses for each package. A CLP-like data deliverables package is required. All laboratory data will undergo the data validation procedures described in the Laboratory QA Manual prior to final reporting. Data will be stored on the laboratory's network until the investigation is complete. Data archived from the LIMS will be transferred to magnetic tape which will be retained by the laboratory an additional five years, minimum.

The equations that will be employed in reducing data are presented in Section 16 of the associated SOPs. The formulas included in the SOP make pertinent allowances for sample matrices. All calculations are checked by a second person prior to data entry into the LIMS. All groundwater metals results will be reported in micrograms per liter (μg/L). Soil and sediment metal results will be reported, corrected for moisture content, in mg/kg. Dust metals results will be reported on an "as received basis" in mg/kg. All blank results and QC data will be included in the data deliverables/package. Blank results will not be subtracted from the sample results. The blank results and QC data will be used in data validation to review sample results qualitatively. Data validation will be performed in general accordance with the guidelines identified in Section 9.2. Outliers and other questionable data will be addressed in the data validation report and specific QA/QC flags will be applied to questionable data. The QA/QC flags will be consistent with the USEPA data validation guidelines.

9.2 DATA VALIDATION PROTOCOL

9.2.1 Field Data Validation Protocol

Validation of the field data will be performed by the PI under the supervision of the QA manager. One hundred percent of the field analytical data will be validated. The procedures to validate the field dat for this investigation include checking for transcription errors and review of logbook, on part of the field crew members. This task will be the responsibility of the PI.

9.2.2 Laboratory Data Validation Protocol

Validation of analytical data as received from the laboratory will be performed by the AGC Quality Assurance Manager or Quality Assurance Scientist. Validation will be performed on 100% of the analytical data in general accordance with the following data validation guidance documents, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Office of Emergency and Remedial Response, USEPA, Washington, D.C. February 1994, where applicable.

Specifically the information examined will consist of sample results, analytical holding times, sample preservation, chain-of-custodies, initial and continuing calibrations, field and laboratory blank analysis results, matrix spike/matrix spike duplicate results, field duplicate results, laboratory control sample results, ICP interference check sample and serial dilution results, qualitative identification, and quantitation of results. If the criteria listed in the analytical method is not met for any parameter the associated samples will be flagged as described in the referenced validation guidelines. During data validation, data are also reviewed for transcription, calculation, and reporting errors and an overall completeness of the data packages will be performed.

The purpose of data validation is to assess the usability of the data by determining if the laboratory analyses met the PARCC criteria set by the site DQO's, the analytical method used and the guidance documents. Upon completion of data validation, the existing results will be reported in tabular form with data validation flags applied as appropriate to determine the usefulness of the data. The data validation flags will be consistent with the USEPA data validation guidelines. A data validation report will be written to assist in making decisions based on the analytical results.

9.3 DATA VALIDATION REPORTS

Data validation reports, along with copies of all support documentation, validated data summary tables, and analytical data packages, will be submitted periodically to RMC Project Manager as data is validated. The RMC Project Manager will forward to the EPA, after adequate time for review, all documents, data and reports. The data validation report will be prepared using USEPA's Region V format.

9.4 DATA REPORTING

9.4.1 Field Data Reporting

Field data reporting will be conducted through the transmission of logbook sheets containing tabulated results of all measurements made in the field, and documentation of all field activities.

9.4.2 Laboratory Data Reporting

All deliverables/packages from each laboratory must be paginated in ascending order. The laboratory must keep a copy of the paginated package in order to be able to respond efficiently to data validation inquiries. Any errors in reporting identified during the data validation process must be corrected by the laboratory as requested. All data validation inquiries to the laboratory must be addressed by a written response from the laboratory in question. CLP-like deliverables are required for this program and must be 100 percent complete from a deliverables standpoint. CLP-like deliverables will include all appropriate CLP summary forms, case narrative, chain-of-custody documents, copies of analysis (instrument) run logs, and raw data for all standards and lab QC samples, and field samples in the form of instrument printouts. The CLP-like deliverables will be provided to the Sampling Contractors Quality Assurance Manager and will be made available to the EPA upon request.

9.5 DATA MANAGEMENT

Once the samples are collected and sent to the laboratory, the field PI will send a copy of the chain-of-custody and field notes to the Sampling Contractor Quality Assurance Manager. The chain-of-custodies will be checked for the appropriate analytical methods defined, parameters requested, number of samples collected and QC samples collected. The laboratory will be contacted if any information on the chain-of-custody is missing or incorrect. The CLP-like deliverables hard copy and electronic data will be provide to the Sampling Contractors QA Manager. The QA Manager will perform an initial check to verify that all the samples were analyzed, the correct methods were used for analyses, all requested parameters were analyzed and samples were analyzed within the holding time requirements. The electronic deliverables will be downloaded into a site specific database and checked with the hard copy deliverables during the data validation process. A project status form will be completed each time a check level is performed. The project status form and check forms are included in Attachment D.

Analytical data, reports, and any other project related information produced during this project will be retained by AGC or its designee. Project reports, tables, etc. may be stored in project specific electronic files. On a regular basis, the data will be backed up on magnetic tapes and stored off-site. The files will be maintained as mandated by the EPA and will be maintained for a minimum six years after the termination of the order. Prior to disposal, the EPA will be offered the evidence file contents.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both the laboratory and field operations will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in this QAPP.

10.1 LABORATORY AUDITS

The purpose of a quality assurance audit is to provide an objective, independent assessment of a measurement effort. The quality assurance audit ensures that the laboratory's data generating, data gathering, and measurement activities produce reliable and valid results. There are two forms of quality assurance audits: performance evaluation audits and system audits.

10.1.1 Performance Evaluation Audits

The purpose of performance evaluation audits is to quantitatively measure the quality of the data. These audits provide a direct evaluation of the various measurement systems' capabilities to generate quality data.

The laboratory regularly participates in performance evaluation audits as part of their laboratory certification efforts. Performance audits are conducted by introducing control samples in addition to those routinely used. Such performance evaluation audits which TriMatrix participates in are USEPA Water Study and Water Pollution Performance Evaluation Studies and ASI National Performance Evaluation Study.

The results of the performance audits are summarized and maintained by the Laboratory QA Supervisor and distributed to the section supervisors who must investigate and respond to any out of control results.

10.1.2 Technical System Audits

A technical systems audit is an on-site, qualitative review of the various aspects of a total sampling and/or analytical system. The purpose of the technical systems audit is to assess the overall effectiveness, and represent an objective evaluation, of a set of interactive systems with respect to strength, deficiencies, and potential areas of concern. Typically, the audit consists of observations and documentation of all aspects of sample analyses. External and internal audits are conducted of the laboratory throughout each year. TriMatrix estimates six to eight external audits by environmental contractors and clients are performed each year.

An audit of the analytical laboratory was performed by AGC in May 1998 to observe conformance to USEPA inorganic methods. EPA Region V performed it's last direct audit of TriMatrix in 1994 while TriMatrix was still a part of WW Engineering & Science.

10.2 FIELD AUDITS

A field audit will be performed by the Sampling Contractor's Quality Assurance Manager during one of the site monitoring sampling events. The audit will take the form of on-site observations of conformance to the QAPP. The external field audit process will include but not be limited to; sampling procedures, sample equipment decontamination procedures, sample bottle preparation and shipment procedures, procedures for collecting field duplicate samples, and field screening practices. Additionally, an internal audit will be performed which will include examination of field sampling records, analytical results, field instrument operation documentation, chain-of-custodies etc. The field audit procedures applicable to the audit must exceed 90 percent positive (proper) responses to meet the acceptance criteria. Follow up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the investigation. The field audit checklist to be used for this project is provided in Attachment C. A report of the field audit will be forwarded to the USEPA Remedial Project Manager by the AGC Project Manager.

11.0 PREVENTATIVE MAINTENANCE

11.1 FIELD EQUIPMENT

Field measurement equipment, OVA, pH meters, thermometers, dissolved oxygen meters, and specific conductance meters will be maintained in accordance with manufacturer's instructions. All field equipment will be checked by qualified technicians prior to use in the field. The instrument operator will be responsible for ensuring that the equipment is operating properly prior to use in the field. Any problems encountered while operating the instrument will be documented in the field logbook. Critical spare parts such as batteries and pH probes will be kept on-site to reduce potential downtime. If problem equipment is detected or should require service, the equipment will be returned and a qualified technician will perform the maintenance required. Use of the instrument will not be resumed until the problem is resolved. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field activities. Routine maintenance of field instruments will be documented in bound logbooks which will be kept with the field instrument. Spare parts and the maintenance schedule are presented on Table 11.1.

11.2 LABORATORY EQUIPMENT

Preventative maintenance and periodic maintenance is performed as recommended by the manufacturers of the equipment in use in the laboratory. Spare parts are kept in inventory to allow for minor maintenance.

The laboratory staff performs preventive maintenance and repairs or coordinates with a vendor for the repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives. The following Table 11.1, summarizes preventive maintenance schedules and critical spare parts inventories. Refer to the SOSs included in Attachment B, for the preventative maintenance program for the ICP/MS and ICP.

TABLE 11.1
REFINED METALS SITE
PREVENTATIVE MAINTENANCE PROCEDURES
SCHEDULE AND SPARE PARTS LIST

Instrument	Activity	Frequency	Spare Parts
ICP	Change peristaltic tubing	Every 8 hours	Tubing
	Change gas and instrument filters	As needed	Gases
	Check to make sure the gas supply is sufficient for days activities	Daily	
	Clean nebulizer	Daily	
Hot plates	Monitor temperature	Daily	
Ovens	Monitor temperature	Daily	
Refrigerators	Monitor Temperature	Daily	
OVA	Calibrate	Daily, throughout day	Batteries
	Check battery	Daily	Spare lamp
	Clean UV lamp, ion chamber and fan	When calibration fails or readings are erratic	
pH meter	Calibrate with two standard solutions	Daily, throughout day	pH buffers Electrodes
	Replace electrodes	As needed	Batteries
Conductivity Meters	Calibrate Check batteries	Daily Daily	Batteries
Thermometer	Check against calibrated thermometer	Yearly	

12.0 SPECIFIC ROUTINE PROCEDURES USED TO EVALUATE DATA PRECISION, ACCURACY AND COMPLETENESS

12.1 PRECISION

The precision of matrix spike and matrix spike duplicate, and field duplicate pairs or laboratory duplicate pairs will be expressed as relative percent difference (RPD) or relative standard deviation (RSD). RPD is derived from the absolute difference between duplicate analyses divided by the mean value of duplicates. The percent RSD is obtained by dividing the standard deviation by the average of the sample set. Equations for RPD and RSD are
presented below:

$$RPD = \frac{|D_1 - D_2|}{((D1+D2)1/2)} \; x \; 100$$

Where:

$D1$ and $D2$ = two replicate values

$$RSD = \frac{S}{X};\ and S = [\sum_{i=1}^{n} (x_i - \bar{x})^2 \; / \; (n-1)]^{1/2}$$

Where:

S = standard deviation

X = average of sample set

x_i = each observed value

x = the arithmetic mean of all observed values

n = total number of values

12.2 ACCURACY

Accuracy will be calculated on the average percent recovery of spiked samples. In order to assure the accuracy of the analytical procedures, an environmental sample shall be spiked with a known amount of the project target analytes. At a minimum, one spike sample shall be included in every set of 20 samples analyzed on each instrument, for each sample matrix to be tested (i.e. soil, sediment and groundwater). The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. Accuracy is similarly assessed though determination of percent recoveries for laboratory control samples. Reference materials are essential to the evaluation of accuracy. Stock solutions for accuracy spikes and laboratory control samples shall be traceable to a source independent from the calibration standards. Accuracy is calculated using the equation below:

$$\%R = \frac{SSR - SR}{SAx100} \quad \text{or} \quad \frac{SR}{TV} = 100$$

Where:

- $\%R$ = percent recovery
- SSR = spiked sample result
- SR = sample result
- SA = amount of spike
- TV = true value (actual mass)

12.3 DATA COMPLETENESS

Completeness is evaluated by dividing the total number of verifiable data points by the maximum number of data points possible and expressing the ratio as a percent. A usability criteria of 90 percent has been set for this project. Following completion of the analytical testing, the percent completeness will be calculated using the following equation:

$$Completeness(\%) = \frac{D}{Pxn} \ x \ 100$$

Where:

D = number of confident quantifications
P = number of analytical parameters per sample requested for analysis
n = number of samples requested for analysis

12.4 ASSESSMENT OF DATA

The field and laboratory data collected during this investigation will be used to evaluate groundwater flow and quality, characterize soil quality, confirm/determine concentrations of lead and cadmium within the buildings and determine whether past drainage areas have been affected by contaminant transport. The QC results associated with each analytical parameter for each matrix will be compared to the objectives presented in Sections 3.8 and 3.9 of this QAPP. Only data generated in association with QC results meeting these objectives will be considered usable for decision making purposes.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, matrix-specific, parameter specific and unit-specific basis. The assessment will be performed by the Quality Assurance Manager and the results will be presented and discussed in detail in the final investigation report. Factors to be considered in this assessment of the field and laboratory data will include, but not necessarily be limited to, the following:

- Were all samples collected using the methodologies and SOPs proposed in the QAPP?
- Were all proposed analyses performed in accordance with the SOPs provided in this QAPP?
- Were samples obtained from all proposed sampling locations and depths?
- Were samples received at the laboratory intact and within holding time requirements?

- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?
- Were all data validated according to the validation documents proposed in this QAPP?
- Were any data found to be unusable (qualified as "R") based on the data validation results?
- Were any data found to be usable for limited purposes (qualified as "J") based on the data validation results?
- What affect due qualifiers applied as a result of data validation have on the ability to implement the project decision rules?
- Has sufficient data of appropriate quality been generated to support a human health and ecological screening risk assessment?
- Can valid conclusions be drawn for each area under this investigation or is further sampling required?
- Were all issues requiring corrective action fully resolved?
- Based on the overall findings of the investigation and this assessment, were the original project objectives appropriately defined? If not, have revised project objectives been developed?

13.0 CORRECTIVE ACTION

When field sampling activities or laboratory quality control results show the need for corrective action, immediate action will take place and will be properly documented. In the event that a problem arises, corrective action will be implemented. Any error or problem will be corrected by an appropriate action which may include:

- Replacing or repairing a faulty measurement system;
- Discarding erroneous data;
- Collecting new data; and
- Accepting the data and acknowledging a level of uncertainty.

13.1 FIELD SAMPLING CORRECTIVE ACTION

The PI will be responsible for all field quality assurance. Any out of protocol occurrence discovered during field sampling will be documented in the field notebook and immediate corrective action will be taken. For problems or situations which cannot be solved through immediate corrective action, the PI will immediately notify the Contractor's Project Manager. The AGC Project Manager and PI will investigate the situation and determine who will be responsible for implementing the corrective action. Corrective action will be implemented upon approval by the AGC Project Manger. The AGC Project Manager will verify that the corrective action has been taken, appears effective, and at a later date, verify that the problem has been resolved. The successfully implemented corrective action will be documented in the field logbook by the PI. Any deviations from the quality assurance protocol in the QAPP must be justified, approved by the AGC Project Manager (and the USEPA, if necessary), and properly documented.

13.2 LABORATORY SITUATION CORRECTIVE ACTION

Corrective action will be implemented to correct discrepancies found which affect the validity or quality of analytical data and to identify any analytical data that may have been affected. Limits of data acceptability for each parameter and sample matrix are addressed in the instrument manuals, USEPA Methods and/or Laboratory QA Manual (Attachment A). Whenever possible, immediate corrective action procedures will be employed. All analyst corrective actions are to be followed according to the instrument manuals, USEPA Methods, or Laboratory QA Manual. Any corrective action performed by analyst will be noted in laboratory logbooks.

Laboratory personnel noting a situation or problem which cannot be solved through immediate corrective action, will notify the Laboratory QA Supervisor. The QA Supervisor will investigate the extent of the problem and its effect on the analytical data generated while the deficiency existed. All data suspected to be affected will be scrutinized to determine the impact of the problem on the quality of the data. If it is determined that the deficiency had no impact on the data, this finding will be documented. If the quality of the analytical data were affected, the Laboratory Program Manager and Contractor's Project Manager will be notified immediately so that courses of action may be identified to determine how to rectify the situation.

The laboratory must take corrective action if any of the quality control data generated during the laboratory analyses are outside the method criteria. Corrective action for out-of-control calibrations is to recalibrate the instrument and reanalyze the samples. A sequence is specified in the USEPA specified methods when problems in analyses are encountered. The laboratory will follow these procedures exactly and document the problems encountered and corrective action in a case narrative enclosed with each data deliverables package.

The Laboratory QA Supervisor will be responsible for informing the Laboratory Program Manager and Sampling Contractor's Project Manager the effects on the data, the data affected and the corrective action taken. It is also the Laboratory QA Supervisor's responsibility to verify the corrective action was performed, appears effective, and at a later date, the problem was resolved.

13.3 DATA VALIDATION QA CORRECTIVE ACTION

Upon completion, sample data packages will be sent from the laboratory to the Sampling Contractor's QA Manager for data validation. If all project samples are not present in the data packages or any deficiencies affecting the sample results are noted, the QA Manager will contact the Laboratory Program Manager. The Laboratory Program Manager will consult with the Laboratory QA Supervisor and respond in writing to any inquiries and provide any changes to the data packages to the QA Manager. Any errors, problems, questionable data values, or data values outside established control limits will be corrected by the appropriate action which may include disregarding erroneous data, collecting new data, and accepting the data and acknowledging a level of uncertainty. The data validation report will provide a description of the usability of the data.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

14.1 QUALITY ASSURANCE REPORT

After project initiation, the Sampling Contractor's Project Manager, in conjunction with the Quality Assurance Manager, will submit with the monthly progress report a written quality assurance summary section in which data quality information collected during the task is summarized. The report will be provided to the RMC Project Manager, who will, in turn after review, forward it to the EPA Remedial Project Manager. The quality assurance summary will provide information on the performance of measurement systems and data quality and will contain at a minimum, the following information (when applicable):

- A description of the actions which have been taken during the sampling event including but not limited to data collection and implementations of the QAPP;
- The results of sampling and tests and all other data received or generated;
- The status and coverage of various laboratory and field quality assurance project activities, including any delays realized or anticipated to affect the project schedule;
- Data quality assurance reviews including assessment of accuracy, precision, completeness, representativeness and comparability;
- Any significant field observations noted in the field notebook during sampling procedures;
- Changes in key personnel and updates on any training provided;
- Significant quality assurance problems encountered, corrective actions taken, progress and improvements, plans and recommendations for further implementation or updating of the QAPP; and
- A summary of the results of laboratory and field performance and system audits, if conducted.

14.2 DATA VALIDATION REPORT

Sample analysis results will be submitted to the RMC Project Manager as they become available, following QA/QC review, for inclusion in the Progress Report. A tabulation of analytical data, including detection limits and data flags will be included in a data validation report. The data validation report will also include a summary of the qualitative and quantitative reliability of the analytical data.

14.3 FREQUENCY OF REPORTS

The QA Report will be provided as a section in the monthly progress reports to the RMC Project Manager who will be responsible for submitting updates to the EPA and IDEM. Reporting will begin at the end of the first full month following the lodging date of the Consent Decree, and continuing throughout the period the Consent Decree is effective. The data validation reports will be submitted to the RMC Project Manager as they become available.

14.4 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

All individuals identified in the Project Organization chart (excluding the Laboratory personnel and the field staff) will receive copies of the monthly QA Report.

ATTACHMENT A

OF THE

QUALITY ASSURANCE PROJECT PLAN

REFINED METALS CORPORATION SITE

LABORATORY QUALITY ASSURANCE MANUAL

AND

STATEMENT OF QUALIFICATIONS

ATTACHMENT B

OF THE

QUALITY ASSURANCE PROJECT PLAN

REFINED METALS CORPORATION SITE

LABORATORY'S PERFORMANCE SAMPLE RESULTS

The TriMatrix Quality Assurance Manual is a Document Controlled Manual and is available upon request from TriMatrix Laboratories, Inc.

ATTACHMENT B

OF THE

QUALITY ASSURANCE PROJECT PLAN
REFINED METALS SITE

STANDARD OPERATING PROCEDURES

TriMatrix Laboratories, Inc.

STANDARD OPERATING PROCEDURE

INTERNAL CHAIN-OF-CUSTODY PROCEDURE

APPROVALS:

QA Manager: Rick D. Wilburn Date: 6/9/98

Laboratory Manager: Douglas E. Kriscunas Date: 6/9/98

Procedure Number: GR-10-104
Revision Number: 2.0

Date Initiated: 8/30/96
Effective Date: 5/22/98

Date Revised: 5/22/98
Pages Revised: All

By: Douglas E. Kriscunas

Total Number of Pages: 7

1.0 SUMMARY OF PROCEDURE

1.1 This SOP establishes uniform policies for a legally-defensible internal chain-of-custody (COC) system for samples requiring a defined level of security. Following these guidelines should provide unbroken tracking of samples from the client source, through the analytical process, to final sample disposition. This procedure also includes the general security measures taken to ensure laboratory integrity is maintained for all analytical areas.

2.0 DETAILED PROCEDURE

2.1 Upon receipt and proper acknowledgment of a cooler containing samples designated as internal chain of custody (COC), the sample technicians must perform a thorough inspection of any custody seals. Should any of the seals arrive damaged, the project chemist and/or the internal client contact must be immediately contacted.

2.2 All paperwork accompanying the sample cooler must be retrieved and checked for completeness and accuracy. Any discrepancies between the received samples and the shipping papers or the project information must be noted.. The project chemist must be informed of the problems, and action taken to explain and correct the errors.

2.3 Only when the samples have been properly accounted for and any discrepancies resolved may they be logged into LIMS. During the log-in process, the option to designate the samples as Internal Chain-of-Custody must be selected. This will initiate the creation of sign-out sheets for each analysis the samples are logged in for (Attachment 1).

2.4 After log-in, the samples will be moved to their designated storage areas and placed on the appropriate shelves (Attachment 2). Access to all sample storage areas is limited to employees only.

2.5 The sign-out sheets are placed in folders located in the laboratory by the walk-in cooler. The sample technicians will ensure each sample has the appropriate type and number of sign-out sheets.

2.6 The incoming samples COC status is communicated to the laboratory areas through the use of arrival logs, worklists, and benchsheets, each of which are generated by LIMS. In addition, managers and group leaders must make sure the chemists and technicians are aware of the COC status of the samples, and that sign-out procedures are strictly followed.

2.7 When preparing to analyze internal COC samples, the sign-out sheet must be completely filled out with removal time, analyst name, and return time. The internal COC forms are filled out each time the samples are removed form their designated storage area. Interim sample storage areas are present in each laboratory area, for use on in-process samples. These storage areas also have access limited to employees only. After signing the samples out from their designated storage area, the samples may be stored in these areas until analyses are complete. Once complete, the samples must be returned to their original location, and the paperwork completed before the analyst may proceed to any other task.

Approved By: Rdw 6/9/98 — QA Manager

Approved By: [signature] 6/9/98 — Area Manager

2.8 When the submittal has been completed, the project chemist must review the contents of the COC folder for each submittal. The project chemist will check the COCs for completeness and then include the paperwork in the project folder.

3.0 REPORTING AND DELIVERABLES

3.1 Examples of all reporting and deliverable requirements are covered in the Attachment/Appendixes section of this SOP, and in the associated analytical SOPs.

4.0 QUALITY ASSURANCE

4.1 All laboratory quality assurance activities as outlined in the TriMatrix Quality Assurance Manual, and as specified in any related Standard Operating Procedures, must be followed.

4.2 The laboratory is a restricted access area. Only authorized personnel are allowed into the laboratory without escorts. Visitors must sign the Visitor Logbook when entering and exiting the laboratory.

4.3 All access doors are secured with electronic keycode locks. Periodic changes in the random access codes are performed to minimize any unauthorized entrance.

4.4 The project chemists is responsible for communicating COC sample information to the sample technicians when this knowledge is available. The project chemist is also responsible for monitoring the progress of the submittal, collecting the COC sign-out sheets when the analyses are completed, and checking each COC for completeness.

4.5 Sample technicians are responsible for receiving, inspecting, and logging in the samples correctly for COC status, and printing and placing sign-out sheets into folders

4.6 Chemists and analysts must strictly follow protocol when performing analyses on COC samples. Each time a sample is removed from its primary storage area, the sign-out sheet must be filled in, including the removal time, return time and a signature, in order to comply with legal integrity standards.

4.7 Laboratory managers and group leaders are responsible for making sure their area chemists are following the COC procedures.

4.8 The overall internal chain-of-custody flow (Attachment 3).

5.0 REFERENCES

5.1 TriMatrix Quality Assurance Manual, current revision.

Approved By: Rdh 6/9/98 — QA Manager
Approved By: Dz 6/9/98 — Area Manager

6.0 ATTACHMENTS/APPENDICES

6.1 Internal Chain-of-Custody Example

6.2 Secure Sample Storage Area Locations

6.3 Laboratory Internal Chain-of-Custody Flow

Approved By: Rd 6/9/98 QA Manager

Approved By: DLC 6/9/98 Area Manager

Attachment 1
Internal Chain-of-Custody Example

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CHAIN OF CUSTODY REPORT FOR AN ENTIRE SUBMITTAL

CLIENT: [redacted] PROJECT: [redacted]

SUBMITTAL: May 18, 1998 Samples PROJECT: 33416-13

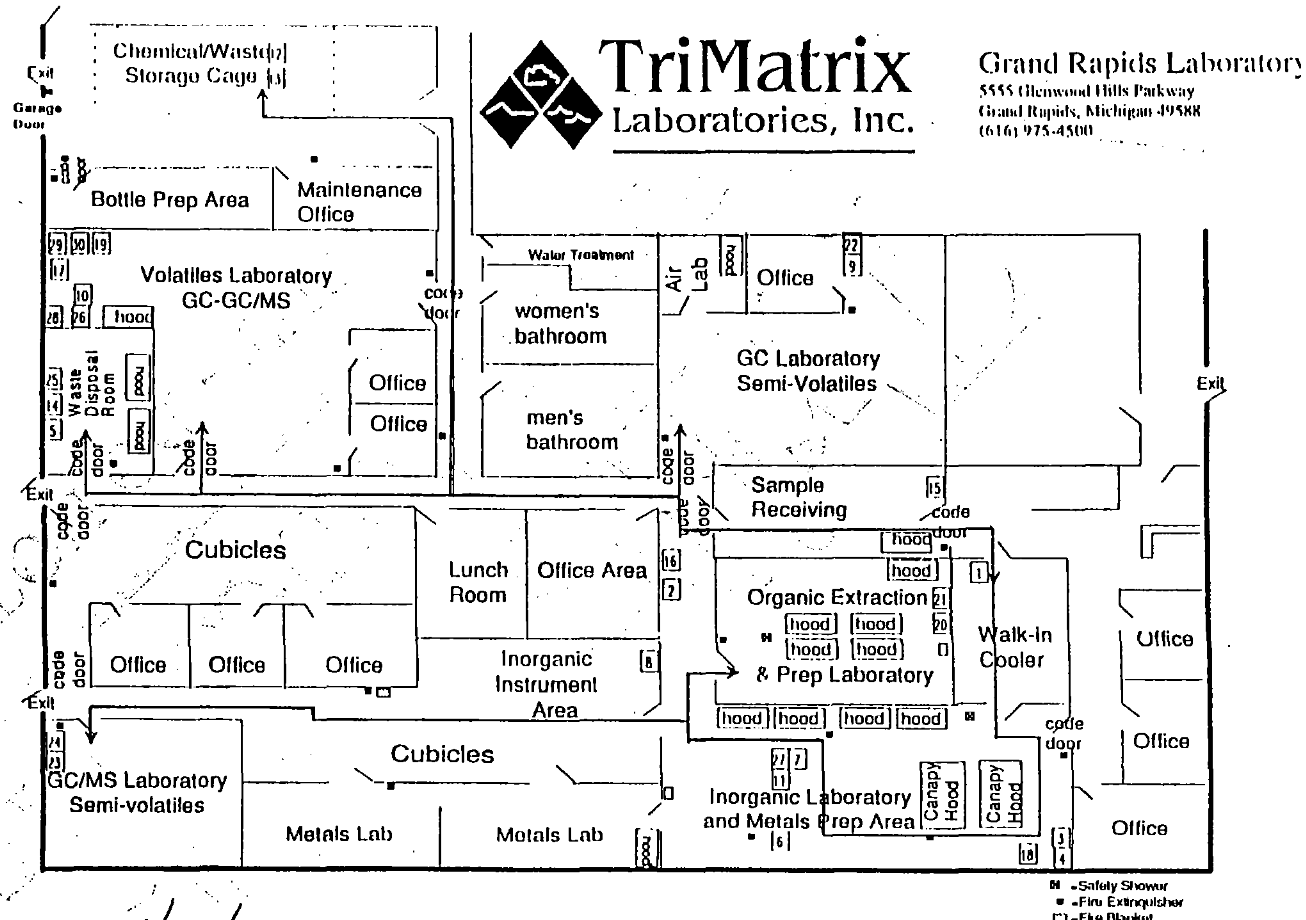
Parameter: EXTRACT: 8270-B/N/A Method: EXT/LQ-LQ/WTR Ref Cit: USEPA-3510B Matrix: WATER

SAMPLE #	REMOVED BY: (SIGNATURE)	DATE & TIME REMOVED	RELINQUISHED BY: DATE & TIME	RECEIVED BY: DATE & TIME	DATE & TIME RETURNED
196850					
196851					
196852					
196853					
196854					
196855					
196856					
196857					
196858					
196859					

Approved By: Rb 6/9/98
QA Manager

Approved By: [signature] 6/9/98
Area Manager

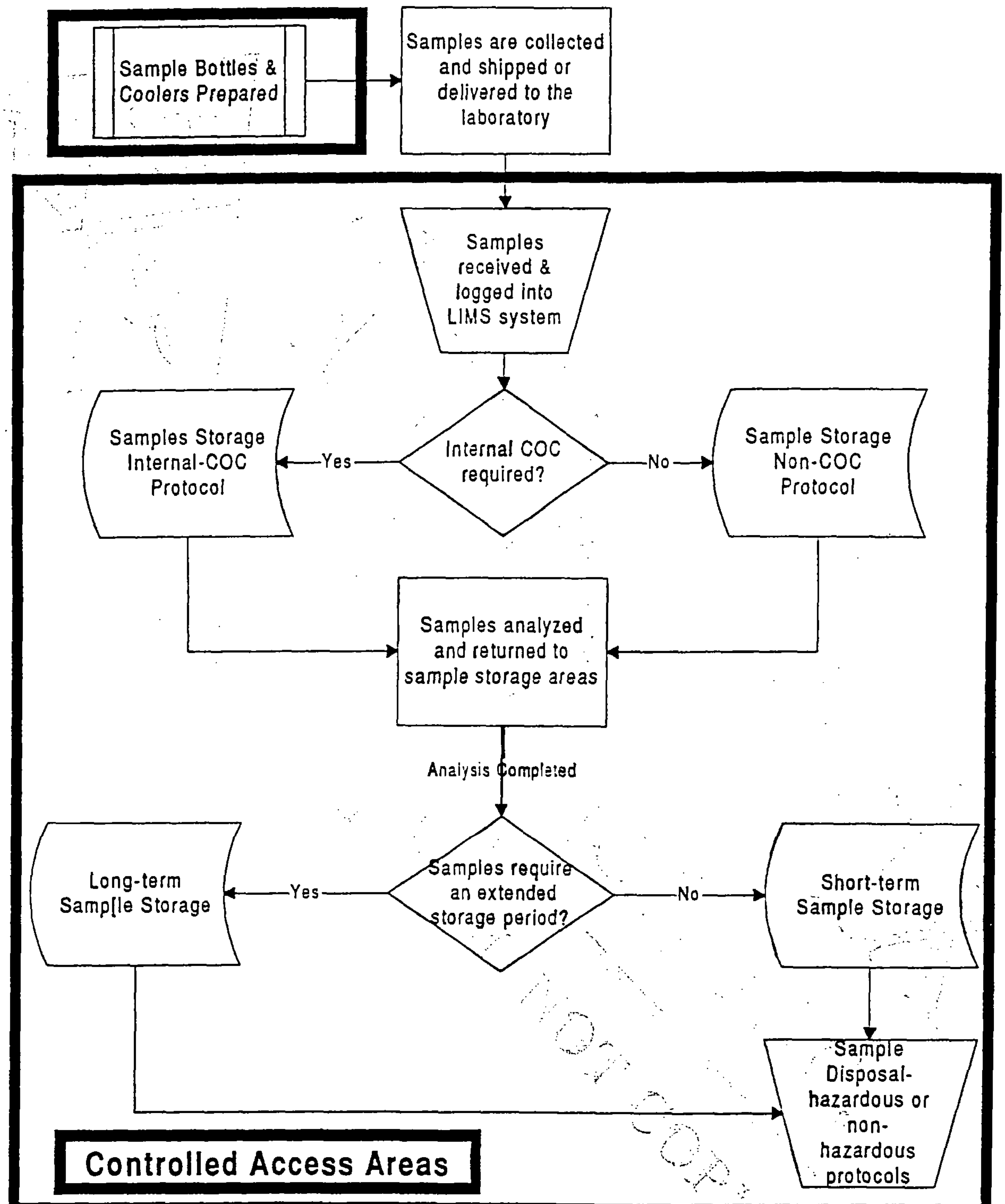
Attachment 2
Secure Sample Storage Area Locations



Approved By: Rd 6/9/98
QA Manager

Approved By: DEC 6/9/98
Area Manager

Attachment 3
Laboratory Internal Chain-of-Custody Flow



Approved By: Rdn 6/9/98
QA Manager

Approved By: Don 6/9/98
Area Manager

TriMatrix
Laboratories, Inc.

STANDARD OPERATING PROCEDURE

METHOD 3005A

ACID DIGESTION OF AQUEOUS SAMPLES AND EXTRACTS FOR TOTAL RECOVERABLE OR DISSOLVED METALS FOR ANALYSIS BY FLAA OR ICP SPECTROSCOPY

APPROVALS:

Metals Supervisor: Betty J Doyle Date: 1-17-96

QA/QC Supervisor: Scott [illegible] Date: 1-18-96

Laboratory Manager: [illegible] Date: 1-18-96

Procedure Number: GR-01-124

Revision Number: 1.0 By: Betty Doyle Effective Date: 1/18/96

Total Number of Pages: 9 Pages Revised: All

TriMatrix

Standard Operating Procedure

Subject: Acid Digestion of Aqueous Samples and Extracts for Total Recoverable or Dissolved Metals for Analysis by FLAA or ICP Spectroscopy	Procedure No: GR-01-124 Revision No: 1.0 Effective Date: 1/18/96
USEPA Method 3005A modified	Page 1 of 9

1.0 METHOD REFERENCE

USEPA SW846, Method 3005A Revision 1, July 1992

2.0 PARAMETER LIST

FLAA or ICP

Aluminum	Magnesium
**Antimony	Manganese
*Arsenic	Molybdenum
Barium	Nickel
Beryllium	Potassium
Cadmium	*Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	

*Analysis by ICP.
**May be analyzed by ICP, FLAA, or GFAA

3.0 SCOPE AND APPLICATION

This method is an acid digestion procedure used to prepare surface and ground water samples for analysis by flame atomic absorption (FLAA) or by inductively coupled plasma (ICP). This method is the only currently approved digestion method for antimony.

Approved By: ST 1-18-96 QA/QC Supervisor Approved By: BJO 1-17-96 Area Supervisor

4.0 SUMMARY OF METHOD

For total recoverable metals, the entire sample is acidified at the time of collection to pH < 2. Prior to analysis, an aliquot of the sample is heated in the presence of HNO_3 and HCl and substantially reduced in volume. The digestate is then filtered, diluted to volume, and analyzed.

This method has been modified. The initial sample volume has been reduced from 100 ml to 50 ml. The acid amounts have been reduced proportionally to the sample size reduction.

5.0 INTERFERENCES AND CORRECTIVE PROCEDURES

5.1 All samples must be at room temperature before the analysis is started.

5.2 This procedure is a "soft" digestion, and may not be sufficiently strong enough to break down some metal complexes.

5.3 For the analysis of antimony, do not let the samples boil. Antimony is easily lost by volatilization from a hydrochloric acid medium.

5.4 This digestion uses hydrochloric acid. Normally, samples containing HCl may not be analyzed by GFAA. Since this is the only approved digestion method for antimony, the digestate from this method may be analyzed by GFAA for antimony only.

6.0 SAFETY PRECAUTIONS

See the "Laboratory Safety Manual" for routine precautions. Gloves and safety glasses must be worn at all times when handling acids. A plastic apron is also recommended. Nitric and hydrochloric acid fumes can burn and therefore respirators are available for use. Rinse all pipet tips, beakers, etc. prior to disposal.

Approved By: SJ 1-18-96 QA/QC Supervisor   Approved By: BJO 1-17-96 Area Supervisor

7.0 SAMPLE SIZE, COLLECTION, PRESERVATION AND HANDLING PROCEDURES

To ensure enough sample for QC and/or repeats collect at least 500 mls of material to be tested. Preserve to pH <2.0 with trace metal nitric acid.

8.0 APPARATUS

8.1 Eppendorf Pipettor (capable of delivering 500 ul).

8.2 Adjustable pump-type dispenser capable of dispensing 1.5 ml of reagent. This pump is for the concentrated HNO_3.

8.3 Adjustable pump-type dispenser capable of dispensing 5.0 ml of reagent. This pump is for the 1:1 HCl.

8.4 Corning hot Plates (setting #4). Model #PC-500.

8.5 Griffin beakers, 150 ml capacity minimum.

8.6 Ribbed watchglasses.

8.7 Class A volumetric flasks.

8.8 Whatman 41 filter paper.

8.9 Plastic funnels.

8.10 Plastic specimen containers.

8.11 Class A Volumetric pipets.

8.12 Graduated cylinder (50 ml).

9.0 ROUTINE PREVENTIVE MAINTENANCE

9.1 Calibrate all pipettors once per week.

9.2 Daily clean all hot plates and counters.

10.0 CHEMICALS AND REAGENTS

10.1 Distilled deionized water (ASTM Type II).

10.2 Concentrated nitric acid, trace metal grade (HNO_3).

10.3 Concentrated hydrochloric acid, trace metal grade (HCl).

10.4 Milli-Q water (ASTM Type I).

10.5 1:1 HNO_3 for cleaning filters. Into 500 ml ASTM Type II water, place 500 ml concentrated HNO_3. Always use a suitable container capable of withstanding the heat generated by the exothermic dilution of the acid. Always add acid to water (failure to do so could result in a violent explosion of acid as the water boils).

11.0 STANDARDS

11.1 If the samples are being digested for FLAA or ICP then refer to Appendix A for the spiking solutions.

11.2 If the sample are being prepared for the analysis of Antimony by GFAA, then refer to Appendix B for the preparation of the spiking solution.

12.0 SAMPLE PREPARATION

12.1 Run a pretreatment benchsheet to determine analyses needed (see Appendix F).

12.2 Rinse 50 ml pipets with ASTM Type II water.

12.3 Label a 150 ml griffin beaker with the sample number, client name, and any dilution information that is pertinent.

12.4 Rinse the pipette with the sample, discarding the rinsate. Transfer a 50-ml aliquot of the well-mixed sample into the 150 ml griffin beaker

12.5 We must perform 5% matrix spikes and matrix spike duplicates. If this sample has been designated as needing matrix QC (MS/MSD), then repeat steps 12.3 and 12.4 with two more aliquots of the sample. Label the first aliquot's beaker with "SPK", and the second one as "MSD". Note: Shake the sample prior to taking each aliquot.

12.6 Repeat steps 12.2 through 12.5 until there are 20 samples in the batch, or until there are no more samples to be prepared.

12.7 Label 1 beaker as MPB (method preparation blank) and 1 beaker as LFB (laboratory fortified blank). Add 50 ml of ASTM Type II water to each of these beakers using a 50 ml graduated cylinder.

12.8 Spiking of samples and LFB

12.8.1 For FLAA and ICP, please refer to Appendix A for spiking amounts. Spike all beakers labeled as "SPK", MSD", and "LFB".

12.8.2 For FNAA, please refer to Appendix B for spiking amounts. Spike all beakers labeled as "SPK", MSD", and "LFB".

TriMatrix

Standard Operating Procedure

Subject:	Acid Digestion of Aqueous Samples and Extracts for Total Recoverable or Dissolved Metals for Analysis by FLAA or ICP Spectroscopy	Procedure No: GR-01-124 Revision No: 1.0 Effective Date: 1/18/96
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12.9 In a hood, add 1.0 ml of trace metal grade HNO_3 and 2.5 ml concentrated HCl. Cover with a ribbed watchglass and place on a hot plate to evaporate. Adjust the temperature on the hotplate so that a beaker of water in the middle of the hotplate reaches 95°C. Do not allow samples to boil.

12.10 Evaporate the samples to a volume of about 10 ml. Do not allow samples to boil. Do not allow the samples to go dry. If a sample evaporates to dryness, the sample must be discarded and reprepped in another batch.

12.11 Cool the samples.

12.12 Rinse enough 50 ml volumetric flasks for all of the beakers in the digestion batch with ASTM Type II water 3 times.

12.13 For each sample, rinse down the sides of the beaker and the watchglass into the beaker. If there is a significant amount of particulate matter left in the beaker, then either filtration or centrifugation may be employed to remove the substances that could prevent nebulization of the samples.

12.13.1 If the amount of particulate matter will not cause analysis problems, then simply pour the contents of the beaker into a 50 ml volumetric flask. Rinse the beaker walls and bottom with ASTM Type II water into the volumetric flask. Repeat the rinsing 2 more times, collecting each rinse in the volumetric flask. Dilute the flask to volume with ASTM Type II water and mix well. Go to Step 12.14.

12.13.2 If the particulate matter will cause analytical problems, the sample may be centrifuged. Pour the contents of the beaker into a volumetric flask. Rinse the beaker walls and bottom with ASTM Type II water into the volumetric flask. Repeat the rinsing 2 more times, collecting each rinse in the volumetric flask. Dilute the flask to volume with ASTM Type II water and mix well. Pour the contents of the flask into a 50 ml centrifuge

Approved By: SG 1-18-96 QA/QC Supervisor Approved By: BRO 1-17-96 Area Supervisor tube. Centrifuge the sample until the sediment has settled into the bottom of the tube (see the centrifuge operating manual for loading and operation of the centrifuge). Go to Step 12.14.

12.13.3 If centrifugation is not possible, or does not work, then the sample may be filtered. Prepare a plastic funnel with Whatman 41 filter paper. Rinse the funnel and filter paper with dilute HNO_3, followed by several rinsings of ASTM Type II water. Discard the rinsate. Place the funnel and filter paper in a 50 ml volumetric flask. Pour the contents of the beaker into the funnel. Rinse the beaker walls and bottom with ASTM Type II water into the funnel. Repeat the rinsing 2 more times, collecting each rinse in the funnel. Rinse the filter paper and funnel with several rinsings of ASTM Type II water. Dilute the flask to volume with ASTM Type II water and mix well. Go to Step 12.14

12.14 Pour the contents of the volumetric flask (or centrifuge tube) into a plastic sample cup labeled with the client name, LIMS samples number, and any digestion dilution information. Place the empty volumetric flasks and beakers in a plastic tub dedicated to dirty glassware.

12.15 Fill out the LIMS pretreatment benchsheet and enter the information into LIMS (see Appendix C). Place the batch number on the pretreatment benchsheet.

12.16 Place the lid on the sample cup and set aside. When all of the samples have been placed in cups, place the batch number of the digestion (see step 12.15) on top of each sample cup in the digestion batch. Place the samples in the appropriate vented cabinet in the metals analysis room.

12.17 Completely fill out the metals digestion logbook and analyst notebook (see Appendix D).

12.18 Clean up the area of any spilled material or debris.

Approved By: SG 1-18-96 — QA/QC Supervisor

Approved By: BJO 1-17-96 — Area Supervisor

13.0 CALIBRATION PROCEDURES (INSTRUMENTAL ANALYSIS)

Not applicable.

14.0 ANALYTICAL PROCEDURE

Not applicable.

15.0 FLOW CHART

Not Available

16.0 CALCULATIONS/DATA HANDLING

Not applicable.

17.0 DATA REPORTING

17.1 LIMS pretreatment requirements (see Appendix C).

18.0 QUALITY ASSURANCE

18.1 One MPB is carried through the entire process to monitor contamination.

18.2 One LFB is carried through the entire process to monitor method accuracy.

18.3 5% matrix spikes/matrix spike duplicates are performed to determine matrix accuracy and precision.

18.4 If a sample is evaporated to dryness, some metals may be volatilized. If any portion of the bottom of the sample container is allowed to go dry, then the sample must be re-pretreated in another digestion batch.

Approved By: SC 1-18-96
QA/QC Supervisor

Approved By: BJO 1-17-96
Area Supervisor

18.5 Samples must not be allowed to boil. If a sample begins to boil, immediately remove it from the heat and turn the temperature down on the hotplate. Excessive boiling of samples will cause loss of analyte. Samples that have been boiled excessively must be repeated in another digestion batch.

18.6 Ensure that the spiking solution being used is within the expiration date. If the standard has expired, do not use the solution. Find another spiking solution that has not expired.

19.0 ANALYSTS CERTIFICATION/METHOD VALIDATION

See Appendix E.

20.0 REFERENCES

20.1 Instruction manuals for pipettors.

20.2 SOP on pipet calibration and monitoring.

20.3 USEPA SW846, Method 3005A Revision 1, July 1992

21.0 APPENDIX

See Attachments.

Approved By: SG 1-18-96 QA/QC Supervisor

Approved By: BDO 1-17-96 Area Supervisor

TriMatrix Laboratories, Inc.

STANDARD OPERATING PROCEDURE

METHOD 3010A

ACID DIGESTION OF AQUEOUS SAMPLES AND EXTRACTS FOR TOTAL METALS FOR ANALYSIS BY FLAA OR ICP SPECTROSCOPY

APPROVALS:

Metals Supervisor: Betty J Doyle Date: 1-17-96

QA/QC Supervisor: Scott Tr... Date: 1-17-96

Laboratory Manager: ______ Date: 1-18-96

Procedure Number: GR-01-121

Revision Number: 1.0 By: Betty Doyle Effective Date: 1/17/96

Total Number of Pages: 10 Pages Revised: All

Subject:	Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy	Procedure No: GR-01-121 Revision No: 1.0 Effective Date: 1/17/96
	USEPA Method 3010A modified	Page 1 of 10

1.0 METHOD REFERENCE

USEPA SW846, Method 3010A Revision 1, July 1992

2.0 PARAMETER LIST

FLAA or ICP

Aluminum	Magnesium
*Arsenic	Manganese
Barium	Molybdenum
Beryllium	Nickel
Boron	Potassium
Cadmium	*Selenium
Calcium	Silicon
Chromium	Silver
Cobalt	Sodium
Copper	Strontium
Iron	Thallium
Lead	Vanadium
Lithium	Zinc
Tin	
Titanium	

*Analysis by ICP.

3.0 SCOPE AND APPLICATION

This method is an acid digestion procedure used to prepare aqueous samples for analysis by flame atomic absorption (FLAA) or by inductively coupled plasma (ICP).

Approved By: SJ 1-17-96 QA/QC Supervisor

Approved By: BJO 1-17-96 Area Supervisor

4.0 SUMMARY OF METHOD

A representative sample is refluxed in nitric acid until the solution is light in color, or the color of the solution remains stable. The digestate is then refluxed with hydrochloric acid and diluted to a predetermined volume.

This method has been modified. The initial sample volume has been reduced from 100 ml to 50 ml. The acid amounts have been reduced proportionally to the sample size reduction.

5.0 INTERFERENCES AND CORRECTIVE PROCEDURES

5.1 Silver precipitation can be avoided by adding an excess of HCl.

5.2 All samples must be at room temperature before the analysis is started.

6.0 SAFETY PRECAUTIONS

See the "Laboratory Safety Manual" for routine precautions. Gloves and safety glasses must be worn at all times when handling acids. A plastic apron is also recommended. Nitric and hydrochloric acid fumes can burn and therefore respirators are available for use. Rinse all pipet tips, beakers, etc. prior to disposal.

7.0 SAMPLE SIZE, COLLECTION, PRESERVATION AND HANDLING PROCEDURES

To ensure enough sample for QC and/or repeats collect at least 500 mls of material to be tested. Preserve to pH <2.0 with trace metal nitric acid.

8.0 APPARATUS

8.1 Eppendorf Pipettor (capable of delivering 500 ul).

8.2 Adjustable pump-type dispenser capable of dispensing 1.5 ml of reagent. This pump is for the concentrated HNO_3.

8.3 Adjustable pump-type dispenser capable of dispensing 5.0 ml of reagent. This pump is for the 1:1 HCl.

8.4 Corning hot Plates (setting #4). Model #PC-500.

8.5 Griffin beakers, 150 ml capacity minimum.

8.6 Ribbed watchglasses.

8.7 Non-ribbed watchglasses.

8.8 Class A volumetric flasks.

8.9 Whatman 41 filter paper.

8.10 Plastic funnels.

8.11 Plastic specimen containers.

8.12 Class A Volumetric pipets.

8.13 Graduated cylinder (50 ml).

9.0 ROUTINE PREVENTIVE MAINTENANCE

9.1 Calibrate all pipettors once per week.

9.2 Daily clean all hot plates and counters.

10.0 CHEMICALS AND REAGENTS

10.1 Distilled deionized water (ASTM Type II).

10.2 Concentrated nitric acid, trace metal grade (HNO_3).

10.3 Concentrated hydrochloric acid, trace metal grade (HCl).

10.4 Milli-Q water (ASTM Type I).

10.5 1:1 HNO_3 for cleaning filters. Into 500 ml ASTM Type II water, place 500 ml concentrated HNO_3. Always use a suitable container capable of withstanding the heat generated by the exothermic dilution of the acid.. Always add acid to water (failure to do so could result in a violent explosion of acid as the water boils).

10.6 1:1 HCl. Into 500 ml ASTM Type II water, place 500 ml concentrated HCl. Always use a suitable container capable of withstanding the heat generated by the exothermic dilution of the acid.. Always add acid to water (failure to do so could result in a violent explosion of acid as the water boils).

11.0 STANDARDS

11.1 FLAA/ICP spiking solutions (Appendix A).

12.0 SAMPLE PREPARATION

12.1 Run a pretreatment benchsheet to determine analyses needed (see Appendix F).

12.2 Rinse 50 ml pipets with ASTM Type II water.

12.3 Label a 150 ml griffin beaker with the sample number, client name, and any dilution information that is pertinent.

12.4 Rinse the pipette with the sample, discarding the rinsate. Transfer a 50-ml aliquot of the well-mixed sample into the 150 ml griffin beaker

12.5 We must perform 5% matrix spikes and matrix spike duplicates. If this sample has been designated as needing matrix QC (MS/MSD), then repeat steps 12.3 and 12.4 with two more aliquots of the sample. Label the first aliquot's beaker with "SPK", and the second one as "MSD". Note: Shake the sample prior to taking each aliquot.

12.6 Repeat steps 12.2 through 12.5 until there are 20 samples in the batch, or until there are no more samples to be prepared.

12.7 Label 1 beaker as MPB (method preparation blank) and 1 beaker as LFB (laboratory fortified blank). Add 50 ml of ASTM Type II water to each of these beakers using a 50 ml graduated cylinder.

12.8 Spiking FLAA/ICP. Using an Eppendorf pipette, spike the following solutions into each beaker labeled with "SPK", "MSD", or "LFB":

500 ul of 50 ppm Ag
500 ul of SSW.1
500 ul of SSW.2

12.9 In a hood, add 1.5 ml of trace metal grade HNO_3. Cover with a ribbed watchglass and place on a hot plate to evaporate. Adjust the temperature on the hotplate so that a beaker of water in the middle of the hotplate reaches 95°C. Do not allow samples to boil.

12.10 Evaporate the samples to a volume of less than 5 ml. Do not allow samples to boil. Do not allow the samples to go dry. If a sample evaporates to dryness, the sample must be discarded and reprepped in another batch.

12.11 Cool the samples.

12.12 Add another 1.5 ml portion of HNO_3 to the samples. Cover the samples with a non-ribbed watchglass and return to the hotplate. Increase the temperature of the hotplate so that a gentle reflux action occurs. Do not let the samples boil. Do not let the samples go to dryness. If a sample evaporates to dryness, the sample must be discarded and reprepped in another batch.

12.13 Continue heating the samples, adding additional 1.5 ml increments of HNO_3 as necessary until the digestion is complete, which will be indicated by the digestate appearing light in color, or not changing in color with additional refluxing. Uncover the beakers, or use a ribbed watchglass, and evaporate to about 3 ml. Do not let any portion of the beaker go dry.

12.14 Cool the samples.

12.15 Add 5.0 ml of 1:1 HCl to the samples. Cover the beakers and reflux for an additional 15 minutes to dissolve any precipitate that may have formed during the digestion.

12.16 Rinse enough 50 ml volumetric flasks for all of the beakers in the digestion batch with ASTM Type II water 3 times.

12.17 For each sample, rinse down the sides of the beaker and the watchglass into the beaker. If there is a significant amount of particulate matter left in the beaker, then either filtration or centrifugation may be employed to remove the substances that could prevent nebulization of the samples.

12.17.1 If the amount of particulate matter will not cause analysis problems, then simply pour the contents of the beaker into a 50 ml volumetric flask. Rinse the beaker walls and bottom with ASTM Type II water into the volumetric flask. Repeat the rinsing 2 more times, collecting each rinse in the volumetric flask. Dilute the flask to volume with ASTM Type II water and mix well. Go to Step 12.18.

12.17.2 If the particulate matter will cause analytical problems, the sample may be centrifuged. Pour the contents of the beaker into a volumetric flask. Rinse the beaker walls and bottom with ASTM Type II water into the volumetric flask. Repeat the rinsing 2 more times, collecting each rinse in the volumetric flask. Dilute the flask to volume with ASTM Type II water and mix well. Pour the contents of the flask into a 50 ml centrifuge tube. Centrifuge the sample until the sediment has settled into the bottom of the tube (see the centrifuge operating manual for loading and operation of the centrifuge). Go to Step 12.18.

12.17.3 If centrifugation is not possible, or does not work, then the sample may be filtered. Prepare a plastic funnel with Whatman 41 filter paper. Rinse the funnel and filter paper with dilute HNO_3, followed by several rinsings of ASTM Type II water. Discard the rinsate. Place the funnel and filter paper in a 50 ml volumetric flask. Pour the contents of the beaker into the funnel. Rinse the beaker walls and bottom with ASTM Type II water into the funnel. Repeat the rinsing 2 more times, collecting each rinse in the funnel. Rinse the filter paper and funnel with several rinsings of ASTM Type II water Dilute the flask to volume with ASTM Type II water and mix well. Go to Step 12.18

12.18 Pour the contents of the volumetric flask (or centrifuge tube) into a plastic sample cup labeled with the client name, LIMS samples number, and any digestion dilution information. Place the empty volumetric flasks and beakers in a plastic tub dedicated to dirty glassware.

12.19 Fill out the LIMS pretreatment benchsheet and enter the information into LIMS (see Appendix C). Place the batch number on the pretreatment benchsheet.

12.20 Place the lid on the sample cup and set aside. When all of the samples have been placed in cups, place the batch number of the digestion (see step 12.19) on top of each sample cup in the digestion batch. Place the samples in the appropriate vented cabinet in the metals analysis room.

12.21 Completely fill out the metals digestion logbook and analyst notebook (see Appendix D).

12.22 Clean up the area of any spilled material or debris.

13.0 CALIBRATION PROCEDURES (INSTRUMENTAL ANALYSIS)

Not applicable.

14.0 ANALYTICAL PROCEDURE

Not applicable.

15.0 FLOW CHART

Not Available

16.0 CALCULATIONS/DATA HANDLING

Not applicable.

17.0 DATA REPORTING

17.1 LIMS pretreatment requirements (see Appendix C).

18.0 QUALITY ASSURANCE

18.1 One MPB is carried through the entire process to monitor contamination.

18.2 One LFB is carried through the entire process to monitor method accuracy.

18.3 5% matrix spikes/matrix spike duplicates are performed to determine matrix accuracy and precision.

18.4 If a sample is evaporated to dryness, some metals may be volatilized. If any portion of the bottom of the sample container is allowed to go dry, then the sample must be re-pretreated in another digestion batch.

18.5 Samples must not be allowed to boil. If a sample begins to boil, immediately remove it from the heat and turn the temperature down on the hotplate. Excessive boiling of samples will cause loss of analyte. Samples that have been boiled excessively must be repeated in another digestion batch.

18.6 Ensure that the spiking solution being used is within the expiration date. If the standard has expired, do not use the solution. Find another spiking solution that has not expired.

19.0 ANALYSTS CERTIFICATION/METHOD VALIDATION

See Appendix E.

20.0 REFERENCES

20.1 Instruction manuals for pipettors.

20.2 SOP on pipet calibration and monitoring.

12.15 Reflux the sampled until the volume is reduced to approximately 5 mls. Do not allow samples to boil or go dry.

12.16 Cool. Add 2 ml ASTM Type II Water and 3 ml of 30% H_2O_2 very slowly to every beaker using an oxford pipet. Be sure that the reaction does not cause the sample to boil out of the beaker! Cover the beaker with a watch glass and return the beaker to the hotplate. Warm on a hot plate until the reaction stops. Cool. NOTE: This step may result in a vigorous reaction due to the peroxide. Be sure that the sample does not effervesce over the side of the beaker. If any of the sample is spilled due to this step, the sample must be discarded and reprepped in another digestion batch.

12.17 Continue to add peroxide in 1 ml aliquots with warming until the samples do not change in appearance, the effervescence is minimal, or until 10 ml of peroxide has been added.

12.18 Cool the samples.

12.19 If the samples are being prepared for ICP/FLAA, then add 10 ml concentrated trace metal HCl and 10 ml ASTM Type II water. Cover the beaker and warm for 15 minutes on the hotplate. Cool. Goto Step 12.21.

12.20 If the samples are being prepared for GFAA, then cover the beaker and reflux until the volume has been reduced to about 5 ml. Cool. Goto Step 12.21.

12.21 Rinse 50 ml volumetric flasks with ASTM Type II water 3 times.

12.22 Rinse watch glass into the beaker with ASTM Type II water. Pour the samples in to 50 ml volumetric flasks. Rinse the contents of the beaker into the flask with ASTM Type II water. Rinse the beaker several times with ASTM Type II water. Dilute the samples, LFB, and MPB to 50 ml with ASTM Type II water.

12.23 The samples may now be allowed to settled, centrifuged, or filtered.

12.23.1 Filtration - Rinse Whatman 41 filter paper which has been inserted into a funnel several times with 1:1 HNO_3 followed by several rinsings with ASTM Type II water. Pour the sample through the filter and collect the filtrate into a centrifuge tube or plastic cup. NOTE: If any of the samples within the batch are filtered, all of the samples within the batch must be filtered.

12.23.2 Centrifugation - Pour the contents of the flask into a 50 ml centrifuge tube. Centrifuge the samples for 10 minutes at 2000-3000 RPM. NOTE: Make sure that the load on the centrifuge is balanced. Please see the Metals Lab Supervisor for instruction on using the centrifuge.

12.23.3 Settling - Pour the contents of the flask into a 50 ml centrifuge tube or sample cup and allow the particles to fall to the bottom of the container. Care must be taken to not disturb the sediment when decanting the sample into the autosampler tubes prior to analysis.

12.24 Label all of the sample containers with the client name, sample number, dilution information, and any other information that may be useful during the analysis. Place the LIMS batch number on the top of the container.

12.25 Pretreat on LIMS to get a batch # (see Appendix C).

12.26 Place samples in appropriate cabinet in metals instrument lab.

12.27 Fill out the pretreatment and lab notebooks (see Appendix D).

13.0 CALIBRATION PROCEDURES (INSTRUMENTAL ANALYSIS)

Not applicable.

14.0 ANALYTICAL PROCEDURE

Not applicable.

15.0 FLOW CHART

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Approved By: BJO 2-1-96 — Area Supervisor

See attachment.

16.0 CALCULATIONS/DATA HANDLING

Not applicable.

17.0 DATA REPORTING

LIMS pretreatment requirements (see Appendix C).

18.0 QUALITY ASSURANCE

18.1 An MPB is carried through the entire process to monitor contamination. One MPB is required for each digestion batch (up to 20 samples).

18.2 An LFB is carried through the entire process to monitor digestion and spiking accuracy. One LFB is required for each digestion batch (up to 20 samples).

18.3 5% matrix spikes must be performed to determine accuracy and check for interferences.

18.4 5% matrix spike duplicates must be performed to determine precision and check for interferences.

18.5 Monitor and document all digestion temperatures as specified section 14.8.

19.0 ANALYSTS CERTIFICATION/METHOD VALIDATION

See Appendix E.

20.0 REFERENCES

20.1 Instruction manuals for pipettors.

20.2 SOP on pipet calibration and monitoring.

20.3 SW846, November 1986 Third Edition. USEPA Method 3050A Revision 1 Date July 1992

21.0 APPENDIX

See referenced appendixes in the TriMatrix Metals Laboratory SOP manual.

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QA/QC Supervisor Area Supervisor

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STANDARD OPERATING PROCEDURE

INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY

PERKIN ELMER ELAN-6000

USEPA METHODS 6020/200.8

APPROVALS:

Metal Manager: ________ Date: 12/4/97
J T Whitmore

QA Manager: ________ Date: 12/4/97
Rick D. Wilburn

Laboratory Manager: ________ Date: 12/4/97
Douglas E. Kriscunas

Procedure Number: GR-01-129
Revision Number: 2.0

Date Initiated: 12/4/97 Date Revised: New
Effective Date: 12/4/97 Pages Revised: New

By: David W. Johnson

Total Number of Pages: 31

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1.0 SCOPE AND APPLICATION

1.1 Inductively coupled plasma mass spectrometry (ICP-MS) is a relatively new methodology applicable to a large range of metallic elements in numerous matrices, including, but not limited to: soil, water, drinking water, wastewater, TCLP extracts, Ept extracts, ASTM extracts, oil, solvents, sludge, air, pure products, and other matrices that may be extracted or dissolved into an acidic aqueous solution. Most matrices require solubilization or digestion prior to analysis.

2.0 PRINCIPLE METHOD REFERENCES

2.1 SW846, November 1986 Third Edition
USEPA Method 6010A Revision 1
Date July, 1992

Method for Chemical Analysis of Water and Wastes
Revised March 1983
USEPA Method 200.7

Code of Federal Regulations
40 CFR Pt. 136, Appendix C

3.0 SUMMARY OF PROCEDURE

3.1 Prior to analysis, the sample must be solubilized or digested using an appropriate sample preparation method. See Methods 3005-3050/200.0/200.7.

3.2 This method describes the multi-elemental determination of analytes by ICP-MS. The method measures ions produced by a radio-frequency inductively coupled plasma. Sample material in solution is introduced by pneumatic nebulization into a radio-frequency plasma where energy transfer processes cause desolvation, atomization and ionization. The ions are extracted from the plasma through a differentially pumped vacuum interface and separated on the basis of their mass-to-charge ratio by a quadrupole and detected by an electron multiplier or Faraday detector and the ion information processed by a data handling system.

3.3 Interferences must be assessed and valid corrections applied or the data flagged to indicate problems. Such corrections must include compensation for isobaric elemental interferences and interferences from polyatomic ions derived from the plasma gas, reagents or sample matrix. Instrumental drift as well as suppressions or enhancements of instrument response caused by the sample matrix must be corrected for by the use of internal standards.

4.0 PARAMETER OR COMPOUND LIST

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QA Manager

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Area Manager

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4.1 This method may be used for the analysis of the following metals.

Aluminum	Molybdenum
Antimony	Nickel
Arsenic	Selenium
Barium	Silver
Beryllium	Thallium
Cadmium	Vanadium
Chromium	Zinc
Cobalt	
Copper	
Lead	
Manganese	

5.0 REFERENCED SOPs

5.1 None referenced with regards to the analysis, however all applicable digestion SOPs would be required to pretreat the samples.

6.0 INTERFERENCES AND CORRECTIVE PROCEDURES

6.1 Isobaric elemental interferences in ICP-MS are caused by isotopes of different elements forming atomic ions with the same nominal mass-to-charge ratio (m/z). A data system must be used to correct for these interferences. This involves determining the signal for another isotope of the interfering element and subtracting the appropriate signal from the analyte isotope signal. Since commercial ICP-MS instruments nominally provide unit resolution at 10% of the peak height, very high ion currents at adjacent masses can also contribute to ion signals at the mass of interest. Although this type of interference is uncommon, it is not easily corrected, and samples exhibiting a significant problem of this type could require resolution improvement, matrix separation, analysis using another verified and documented isotope, or use of another method. Several interference sources may cause inaccuracies in the determination of trace elements by ICP-MS. These are:

6.1.1 Isobaric elemental interferences - Are caused by isotopes of different elements which form singly or doubly charged ions of the same nominal mass-to-charge ratio and which cannot be resolved by the mass spectrometer. All elements determined by this method have, at a minimum, one isotope free of isobaric elemental interference. Of the analytical isotopes recommended for use with this method, only molybdenum-98 (ruthenium) and selenium-82 (krypton) have isobaric elemental interferences. If alternative isotopes having higher natural abundance are selected in order to achieve greater sensitivity, an isobaric interference may occur. All data obtained under such conditions must be corrected by measuring the signal from another isotope of the interfering element and subtracting the appropriate signal ratio from the

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isotope of interest. A record of this correction process should be included with the report of the data. It should be noted that such corrections will only be as accurate as the accuracy of the isotope ratio used in the elemental equation for data calculations. Relevant isotope ratios should be established prior to the application of any corrections.

6.1.2 Isobaric polyatomic ion interferences - Are caused by ions consisting of more than one atom which have the same nominal mass-to-charge ratio as the isotope of interest, and which cannot be resolved by the mass spectrometer in use. These ions are commonly formed in the plasma or interface system from support gases or sample components. Such interferences must be recognized, and when they cannot be avoided by the selection of alternative analytical isotopes, appropriate corrections must be made to the data. Equations for the corrections for data should be established at the time of the analytical run sequence as the polyatomic ion interferences will be highly dependent on the sample matrix and chosen instrument conditions. In particular, the common ^{82}Kr interference that affects the determination of both arsenic and selenium, can be greatly reduced with the use of high purity krypton free argon.

6.1.3 Abundance sensitivity - Is a property defining the degree to which the wings of a mass peak contribute to adjacent masses. The abundance sensitivity is affected by ion energy and quadrupole operating pressure. Wing overlap interferences may result when a small ion peak is being measured adjacent to a large one. The potential for these interferences should be recognized and the spectrometer resolution adjusted to minimize them.

6.1.4 Memory interferences - Result when isotopes of elements in a previous sample contribute to the signals measured in a new sample. Memory effects can result from sample deposition on the sampler and skimmer cones, and from the buildup of sample material in the plasma torch and spray chamber. The site where these effects occur is dependent on the element and can be minimized by flushing the system with a rinse blank between samples. The possibility of memory interferences should be recognized within an analytical run and suitable rinse times should be used to reduce them. The rinse times necessary for a particular element should be estimated prior to analysis. This may be achieved by aspirating a standard containing elements corresponding to ten times the upper end of the linear range for a normal sample analysis period, followed by analysis of the rinse blank at designated intervals. The length of time required to reduce analyte signals to within a factor of ten of the method detection limit should be noted. Memory interferences may also be assessed within an analytical run by using a minimum of three replicate integrations for data acquisition. If the integrated signal values drop consecutively, the analyst should be alerted to the possibility of a memory effect, and should examine the analyte concentration in the previous sample to identify if this was high. If a memory interference is suspected the sample should be reanalyzed after a long rinse period. In the determination of mercury, which suffers from severe memory effects, the addition of 100 ug/L gold will effectively rinse 5 ug/L mercury in approximately 2 minutes. Higher concentration will require a longer rinse time.

6.2 Isobaric molecular and doubly-charged ion interferences in ICP-MS are caused by more than one atom or charge, respectively. Most isobaric interferences that could affect ICP-MS determinations have been

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identified in the literature. Examples include $ArCl^+$ ions on the ^{75}As signal and MoO^+ ions on the cadmium isotopes. While the approach used to correct for molecular isobaric interferences is demonstrated below using the natural isotope abundances from the literature, the most precise coefficients for an instrument can be determined from the ratio of the net isotope signals observed for a standard solution at a concentration providing suitable (<2 percent) counting statistics. Because the ^{35}Cl natural abundance of 75.77 percent is 3.13 times the ^{37}Cl abundance of 24.23 percent, the chloride correction for arsenic can be calculated (approximately) as follows (where the $^{38}Ar^{37}Cl^+$ contribution at m/z 75 is a negligible 0.06 percent of the $^{40}Ar^{35}Cl^+$ signal):

corrected arsenic signal (using natural isotope abundances for coefficient approximations) =

[(m/z 75 signal) - ((3.13)(m/z 77 signal)) + ((2.73)(m/z 82 signal))]

where the final term ((2.73)(m/z 82 signal)) adjusts for any selenium contribution at m/z 77

NOTE: Cadmium values will be biased low by this type of equation when $^{92}ZrO^+$ ions contribute at m/z 108, but use of m/z 111 for Cd is even subject to direct ($^{94}ZrO^+$) additive interferences when Zr is present.

NOTE: As for the arsenic equation above, the coefficients in the Cd equation are ONLY illustrative. The most appropriate coefficients for an instrument can be determined from the ratio of the net isotope signals observed for the standard solution at a concentration providing suitable (<1 percent) counting precision.

6.2.1 The accuracy of these types of equations are based upon the constancy of the OBSERVED isotopic ratios for the interfering species. Corrections that presume a constant fraction of a molecular ion relative to the "parent" ion have not been found to be reliable, e.g., oxide levels can vary. If a correction for an oxide ion is based upon the ratio of parent-to-oxide ion intensities, the correction must be adjusted for the degree of oxide formation by the use of an appropriate oxide as the interferent. This type of correction has been reported for oxide-ion corrections using ThO^+/Th^+ for the determination of rare earth elements. The use of aerosol desolvation and/or mixed plasmas have been shown to greatly reduce molecular interferences. These techniques can be used provided that method detection limits, accuracy, and precision requirements for analysis can be met.

6.3 Physical interferences are associated with the sample nebulization and transport processes as well as with ion-transmission efficiencies. Nebulization and transport processes can be affected if a matrix component causes a change in surface tension or viscosity. Changes in matrix composition can cause significant signal suppression or enhancement. Dissolved solids can deposit on the nebulizer tip of a pneumatic nebulizer and on the interface skimmers (reducing the orifice size and the instrument performance). Total solid levels below 0.2%(2,000 mg/L) have been currently recommended to minimize solid deposition. An internal standard can be used to correct for physical interferences, if it is carefully matched to the analyte so that the two elements are similarly affected by matrix changes. When the intensity level of an internal standard is less than 70 percent or greater than 120 percent of the intensity of the first standard used

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during calibration, the sample must be reanalyzed after a fivefold (1+4) or greater dilution has been performed.

6.4 Memory interferences can occur when there are large concentration differences between samples or standards which are analyzed sequentially. Sample deposition on the sampler and skimmer cones, spray chamber design, and the type of nebulizer affect the extent of the memory interferences which are observed. The rinse period between samples must be long enough to eliminate significant memory interference.

7.0 SAFETY PRECAUTIONS

7.1 The analyst must comply with all standard operating procedures for health and safety as outlined in the "TriMatrix Laboratory Safety Manual".

7.2 Concentrated acids are used in the preparation of standards and samples for analysis by ICP-MS. Gloves and safety glasses must be worn at all times when handling concentrated acids. Gloves must also be worn when handling digested samples. Please refer to the MSDS for information on these or any other chemicals utilized in this procedure.

7.3 Check the exhaust hood over the instrument to be sure it is operating correctly. If the ventilation system is not working properly, extinguish the plasma if lit and immediately contact the metals lab manager. Under no circumstances should the ICP-MS be used if the exhaust hood is not working.

7.4 UV protective glasses must be worn at all times in the metals laboratory. The plasma emits UV radiation. Avoid looking directly at the plasma without some type of strong UV protection. The instrument uses a very UV resistant material in the viewing port as the analyst may watch the plasma. Do not tamper with this plate. Do not operate the machine without this plate in place. Do not attempt to view the plasma directly or indirectly in any way. Failure to follow this policy may cause very serious and immediate damage to the retina of the eye.

7.5 The ICP-MS emits a strong Rf field. To minimize exposure to this field, Perkin Elmer has included several safety interlocks to prevent direct exposure of the analyst to harmful radiation. Never override any interlock on the ICP-MS. When working on the instrument, always replace all of the Rf shielding using all of the supplied screws. If any safety device has been tampered with, contact the metals lab manager.

7.6 The ICP uses Ar to sustain the plasma and to nebulize sample into the plasma. Although Ar in and of itself is not hazardous or flammable, it may cause suffocation through oxygen deprivation. It is therefore imperative that all sources of Ar be turned off with a valve when not in use. Since Ar is colorless and odorless, if you feel lightheaded, please evacuate the metals lab at once and notify the metals lab manager. Please refer to the MSDS for information on this or any chemicals utilized in this procedure.

7.7 Many of the elements used in the procedure are toxic if ingested. Please refer to the MSDS for information on these or any other chemicals utilized in this procedure.

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7.8 No food or drink is allowed in the metals lab. Food or drink may become contaminated with acid or metals and may therefore be hazardous.

7.9 Wash hands before starting work. Chemicals may be present on the skin which may interfere with metals analysis. Wash hands before leaving the metals lab. Chemicals and acids may be on the skin which could eventually be ingested or passed on to a second party through casual contact.

8.0 SAMPLE SIZE, COLLECTION, PRESERVATION AND HANDLING PROCEDURES

8.1 Aqueous samples must be acidified at the time of collection to a pH of <2.

8.2 Solid samples require no preservation for metals.

8.3 All samples may be collected in glass or plastic. If Silicon or Boron is to be analyzed, plastic containers must be used. The acidified sample must never come into contact with any metal as this would cause leaching of the metal into the sample.

8.4 For the analysis of dissolved metals, the sample should be filtered on site and then acidified to a pH of <2.

8.5 Holding times for all metals for ICP analysis is 180 days. In the case of TCLP or similar extracts, the hold time starts at the time of filtration.

8.6 The minimum sample size for this method is 3 ml of aqueous sample per metal to be analyzed. This implies that the sample must be solubilized prior to analysis. A smaller minimum amount may be used if the sample will be diluted at the sacrifice of the detection limit.

8.7 Digested (solubilized) samples and undigested acidified aqueous samples need not be refrigerated. Solid samples should be refrigerated so that other parameters may be performed on them. All samples must be at room temperature prior to analysis.

9.0 INSTRUMENTATION, APPARATUS, AND MATERIALS

9.1 Inductively coupled plasma mass spectrometer.

9.1.1 Instrument capable of scanning the mass range 5-250 amu with a minimum resolution capability of 1 amu peak width at 5% peak height. Instrument may be fitted with a conventional or extended dynamic range detection system. The instrument should also include data system that will allow corrections for isobaric interferences and the application of the internal standard technique. Use of a mass-flow controller for the nebulizer argon and a peristaltic pump for the sample solution are recommended.

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NOTE: If an electron multiplier detector is being used, precautions should be taken, where necessary, to prevent exposure to high ion flux. Otherwise changes in instrument response or damage to the multiplier may result.

9.1.2 Radio-frequency generator compliant with FCC regulations.

9.1.3 Argon gas supply - High purity grade (99.99%). When analysis are conducted frequently, liquid argon is more economical and requires less frequent replacement of tanks than compressed argon in conventional cylinders (Section 4.1.3).

9.1.4 A variable-speed peristaltic pump is required for solution delivery to the nebulizer.

9.1.5 A mass-flow controller on the nebulizer gas supply is required.

9.2 Analytical balance, with the capability of measuring to 0.1 mg for use in weighing solids, for preparing standards, and for determining dissolved solids in digestates or extracts.

9.3 A temperature adjustable hot plate capable of maintaining a temperature of 95° C.

9.4 Recirculator/chiller, Neslab CFT750 or equivalent. Temperature should be maintained at 18° C and pressure should be at 35-60 psi. The recirculator is attached directly to the mass spectrometer to maintain isothermal conditions.

9.5 15 ml clear centrifuge tubes or equivalent. Tubes should stand upright within the autosampler rack without tipping or leaning.

9.6 Eppendorf auto-pipettors capable of delivering 5-1000 ul.

9.7 Class A volumetric flasks, various volumes.

9.8 Class A reusable pipettes, various volumes.

9.9 (optional) An air displacement pipettor capable of delivering volumes ranging from 0.1 to 2500 uL with an assortment of high quality disposable pipet tips.

9.10 Mortar and pestle, ceramic or nonmetallic material.

9.11 Polypropylene sieve, 5-mesh (4 mm opening).

9.12 A gravity convection drying oven with thermostatic control capable of maintaining 105° C $\pm$ 5° C.

10.0 ROUTINE PREVENTIVE MAINTENANCE

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SOP Name:	Inductively Coupled Plasma Mass Spectrometry USEPA Methods 6020/200.8		Revision Number:	2.0
			Date Revised:	New
SOP Number:	GR-01-129	page 9 of 31	Date Initiated:	12/4/97

10.1 All maintenance activities must be recorded in the instrument maintenance, or instrument run logbook. Daily maintenance activities are recorded in the run logbook. All other maintenance activities must be recorded in the instrument maintenance logbook.

10.2 At the beginning of each shift (every 8 hours) the manifold pump tubing must be replaced. This must be recorded in the instrument run logbook.

10.3 There are 2 filters on the ELAN 6000 that must be replaced periodically. The two filters are located on the back of the instrument. This must be noted in the instrument maintenance logbook.

10.4 Inspect the Ar supply when the shift begins. If the liquid level of the Ar falls below the re-order mark, notify the person responsible for ordering gasses or the metals manager. This must be recorded in the instrument run logbook.

10.5 Inspect the water container on the floor alongside the instrument every shift. If the jug is full, properly dispose of the liquid. This must be recorded in the instrument run logbook.

10.6 Visually inspect the torch before lighting the instrument. Do not touch or move the torch. The inspection should be visible only. This must be recorded in the instrument run logbook.

10.6.1 Open the vacuum chamber.

10.6.2 Observe the torch. If the torch is broken or cracked, replace it. See section 10.7 for a discussion on how to disassemble the torch and assembly.

10.6.3 Listen for any obvious leaks in the Ar lines going to the torch and nebulizer. If leaks are heard, investigate them and tighten the fittings to stop the leak. If the leak cannot be found or cannot be stopped, contact the metals lab manager.

10.7 Once every four to eight weeks disassemble the entire torch assembly and inspect all parts for wear. Replace all worn or damaged parts. Record all changes in the instrument maintenance logbook.

10.7.1 Turn off the plasma if it is on by selecting instrument, then front panel, then stop on the plasma box. The pump will stop when the plasma is extinguished.

10.7.2 Turn off the RF Generator by turning off the circuit breaker labeled RF Generator (CB1) on the left side of the instrument.

10.7.3 Loosen the retaining ring and remove the spray chamber assembly.

10.7.4 Open the top left cover of the ELAN 6000. Use a flat blade screw driver on the release mechanism to release the vacuum chamber interlock lever. Grasp the lever and pull in counter clockwise direction to slide the vacuum chamber and interface away from the torch box.

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10.7.5 Remove the gas line connections from the ICP torch by loosening the swagelock fittings. Then slide the fittings and connection tubing up and off of the ICP torch.

10.7.6 To remove the torch assembly, rotate the torch mount 1/8 turn counter clockwise and remove the entire assembly through the right side of the torch box.

10.7.7 With one hand grasping the ICP torch and the other holding onto the lexan adapter, twist and pull back on the adapter to separate the adapter from the torch.

10.7.8 Inspect all O-rings and replace any that are cracked or damaged. Record in maintenance log book.

10.7.9 Remove the Alumina injector. If it is dirty wash it with soap and water, dry, then put in the muffle furnace at 700° C for 20 min.

10.7.10 If the torch is dirty immerse it in an ultrasonic cleaner containing 1% nitric acid. Rinse with deionized water. If the torch cannot be cleaned or is damaged, replace.

10.7.11 After the torch has been cleaned or replaced, follow these steps to reposition and align the ICP torch.

10.7.11.1 Slide the injector/support adapter to the back of the torch.

10.7.11.2 Place the torch through the hole in the right side of the torch box. Rotate the torch assembly 1/8 turn clockwise until the bayonet mount is fully seated.

10.7.11.3 Reattach the gas lines to the ICP torch. Slide both the fittings and connecting tubing onto the torch and tighten the swagelock fittings several turns.

10.7.11.4 To check the position and measure for the proper alignment of the torch follow steps 10.7.11.5 through 8.

10.7.11.5 Place the torch alignment tool on the torch so that the flange of the alignment tool touches the first turn of the load coil. Loosen the torch locking collar approximately 1 cm and slide the torch so that it is lined up with the outer edge of the torch.

10.7.11.6 Slide the tool out approximately 1/2 inch and, using the lever, move the vacuum chamber interlock into the lock position.

10.7.11.7 Move the vacuum chamber to the closed position to locate the alignment tool within the load coil.

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10.7.11.8 Move the chamber to the open position and adjust the vacuum chamber position so the top end of the torch is even with the 5.5 mm cutout depth of the alignment tool.

10.7.11.9 If the torch is not properly lined up, loosen the two locking screws of the vacuum chamber interlock. Adjust the vacuum chamber forwards or backwards until the proper position is achieved.

10.7.11.10 Slide the vacuum chamber and interface toward the torch box. Secure the vacuum chamber interlock and close the top cover.

10.7.11.11 Turn on the RF Generator by turning on the circuit breaker labeled ICP Power (CB1) on the side of the instrument.

10.7.12 Inspect the drain line at the base of the spray chamber. There should be no leaks or cracks in the tubing. If a problem exists, replace the O-ring in the drain cap. This must be recorded in the instrument maintenance logbook.

10.7.13 Inspect the nebulizer for wear. This must be recorded in the instrument run logbook.

10.7.13.1 Salt deposits, if present, should be removed with water. Record any actions in the instrument maintenance logbook.

10.7.13.2 If a cross-flow nebulizer is used, check the tips for wear. Replace the tips if excessive wear is noted. Record any actions in the instrument maintenance logbook.

10.8 Inspect the printing quality of the printer. If the print is hard to read or light in appearance, replace the printer cartridge with the appropriate replacement.

11.0 CHEMICALS AND REAGENTS

11.1 Acids used in the preparation of standards and for sample processing must be reagent grade or better. Redistilled acids may be used if it has been demonstrated that the acid is free from contamination.

11.1.1 Concentrated Nitric acid, trace metal grade (Fisher Cat #A509-212).

11.1.2 Nitric acid, trace metals grade (1:1): Add 500 ml concentrated HNO_3 to 400 ml ASTM Type II water. Cool. Dilute to 1L.

11.2 ASTM Type II water (ASTM D1193). Deionized water is fed into a Barnstead Model FI-STREEM 2 all glass distillation unit. The resulting distillate is immediately placed into a plastic container. Impurities

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are measured by the Inorganic group at TriMatrix. This is the only water acceptable for use in the Metals lab for dilutions or standard preparation.

11.3 Standard stock solutions are purchased primarily form Inorganic Ventures. All stock solutions are ICP grade single-element solutions at concentrations of 1000 or 10,000 ppm.

11.4 Argon gas supply: Welding grade or better. This is plumbed from a liquid argon tank located outside of the building. Ar is used as the main plasma gas, the auxiliary plasma gas, the nebulizer carrier gas, and the Rf coil coolant.

12.0 STANDARDS PREPARATION

12.1 All standards should be prepared with ASTM Type II water and 2% HNO_3 (for analysis of all samples).

12.2 All primary standards expire one year after receipt or on the date located on the standard bottle, whichever is earlier.

12.3 All working standards and dilutions of working standards for the ICP that are prepared from primary standards expire 3 months after preparation.

12.4 Prepare the 20 ppm working standard ELAN A.

12.4.1 Wash a plastic 100 ml volumetric flask with Citranox and hot water. Put 2 ml of concentrated HNO_3 acid into the volumetric and shake. Rinse the volumetric with ASTM Type II water a minimum of three times.

12.4.2 Place about 10 ml ASTM Type II water into the flask.

12.4.3 Pipette 2 ml HNO_3 into the flask and swirl.

12.4.4 Pipette 2 ml of each of the following standards into the flask, swirling after each addition:

Be, Al, V, Cr, Mn, Co, Ni, Cu, Zn, As, Se, Ag, Cd, Ba, Tl, Pb

Always use a new pipette for each standard and never pipette directly out of the primary standard bottle

12.4.5 Dilute the flask to volume with ASTM Type II water and mix well.

12.4.6 Pour the contents of the flask into a clean bottle and label the bottle to describe its contents.

12.4.7 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

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12.5 Prepare the 20 ppm standard ELAN B

12.5.1 Wash a 100 ml plastic volumetric with Citranox and hot water. Put 2 ml of concentrated HNO_3 acid into the volumetric and shake. Rinse the volumetric with ASTM Type II water a minimum of three times.

12.5.2 Place about 10 ml ASTM Type II water into the flask.

12.5.3 Pipette 2 ml HNO_3 into the flask and swirl.

12.5.4 Pipette 2 ml each of the 1000 ppm Sb and Mo stock standards into the flask, swirling after each addition. Always use a new pipette for each standard and never pipette directly out of the primary standard source bottle.

12.5.5 Dilute the flask to volume with ASTM Type II water and mix well.

12.5.6 Pour the contents for the flask into a clean bottle and label the bottle to describe its contents.

12.5.7 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

12.6 Prepare the mixed working standards.

12.6.1 Rinse seven 50 ml, and one 100 ml volumetric flasks with ASTM Type II water a minimum of three times.

12.6.2 Place about 20 ml ASTM Type II water into each volumetric flasks.

12.6.3 Each standard should have an acid concentration of 2%. Pipette 1 ml of concentrated nitric acid into each of the 50 ml volumetric flasks, and 2 ml into the 100 ml volumetric flask to achieve this concentration.

12.6.4 Pipette 25 ul of ELAN A solution and 25 ul ELAN B solution into one of the 50 ml volumetric flasks. Dilute to volume with ASTM Type II water and mix. This is a 10 ppb standard.

12.6.5 Pipette 50 ul of ELAN A solution and 50 ul ELAN B solution into one of the remaining 50 ml volumetric flasks. Dilute to volume with ASTM Type II water and mix. This is a 20 ppb standard.

12.6.6 Pipette 125 ul of ELAN A solution and 125 ul of ELAN B solution into one of the remaining 50 ml volumetric flasks. Dilute to volume with ASTM Type II water and mix. This is a 50 ppb standard.

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12.6.7 Pipette 250 ul of ELAN A solution and 250 ul of ELAN B solution into one of the remaining 50 ml volumetric flasks. Dilute to volume with ASTM Type II water and mix. This is a 100 ppb standard.

12.6.8 Pipette 40 ul of the 100 ppb standard into the 100 ml volumetric flask. Dilute to volume with ASTM Type II water and mix. This is a 0.04 ppb standard.

12.6.9 Pipette 100 ul of the 100 ppb standard into one of the remaining 50 ml volumetric flasks. Dilute to volume with ASTM Type II water and mix. This is a 0.20 ppb standard.

12.6.10 Pipette 500 ul of the 100 ppb standard into one of the remaining 50 ml volumetric flask. Dilute to volume with ASTM Type II water and mix. This is a 1.0 ppb standard.

12.6.11 Dilute the acid to volume in the final 50 ml volumetric flask with ATSM Type II water and mix. This is a 0 ppb standard.

12.6.12 Update the standard log book. Transfer the stock standard numbers and preparation date to the standard bottles.

12.7 Prepare the Interference Check Solutions (ICS).

12.7.1 The ICSs are prepared to contain known concentrations of interfering elements that will demonstrate the magnitude of interferences and provide an adequate test of any corrections. Chloride in the ICS provides a means to evaluate software corrections for chloride-related interferences such as $^{35}Cl^{16}O^+$ on $^{51}V^+$ and $^{40}Ar^{35}Cl^+$ on $^{75}As^+$. Iron is used to demonstrate adequate resolution of the spectrometer for the determination of manganese. Molybdenum serves to indicate oxide effects on cadmium isotopes. The other components are present to evaluate the ability of the measurement system to correct for various molecular-ion isobaric interferences. The ICS is used to verify that the interference levels are corrected by the data system within quality control limits.

12.7.2 These solutions must be prepared from ultra-pure reagents. They can be obtained commercially or prepared by the following procedure.

12.7.2.1 Mixed ICS solution I is prepared by weighing into individual weigh boats the following chemicals: 1.39g $Al(NO_3)_3 \cdot 9H_2O$, 0.25g $CaCO_3$ (dried at 180°C for 1 hour before weighing), 0.10g Fe, 1.7g MgO, 0.23g Na_2CO_3, and 0.18g K_2CO_3. These are then added to a 100 ml volumetric flask containing approximately 25 ml of ASTM Type II water. Slowly add 4 ml of (1+1) HNO_3. After dissolution is complete, warm the solution to degas. Cool and dilute to volume ml with ASTM Type II water.

12.7.2.2 Mixed ICS solution II is prepared by weighing into individual weigh boats the following chemicals: 0.74g 85% H_3PO_4, 0.64g 96% H_2SO_4, 4.0g 37% HCl, and

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1.1g citric acid ($C_6O_7H_8$). These are then added to a 100 ml volumetric flask containing approximately 25 ml of ASTM Type II water. Dilute to volume with ASTM Type II water.

12.7.2.3 Mixed ICS solution III is prepared by adding 1.0 ml each of 100 ug/ml arsenic, cadmium, chromium, cobalt, copper, manganese, nickel, silver, and zinc stock solutions to a 100 ml volumetric flask approximately half full of ASTM Type II water. Add 2.0 ml concentrated HNO_3, and dilute to volume with ASTM Type II water.

12.7.2.4 Working ICS Solutions

12.7.2.4.1 ICS-A is prepared by adding to a 100 ml volumetric flask, 10.0 ml of mixed ICS solution I, 5.0 ml of mixed ICS solution II, and 2.0 ml each of 100 ug/ml titanium and molybdenum stock solutions. Dilute to volume with ASTM Type II water and update the standard logbook. ICS-A must be prepared fresh weekly.

12.7.2.4.2 ICS-AB is prepared by adding to a 100 ml volumetric flask, 10.0 ml of mixed ICS solution I, 5.0 ml of mixed ICS solution II, 2.0 ml of mixed ICS solution III, and 2.0 ml each of 100 ug/ml titanium and molybdenum stock solutions. Dilute to volume with ASTM Type II water. Although ICS-AB must be prepared fresh weekly, the analyst should be aware that the solution may precipitate silver more quickly. Update the standard log book.

12.7.2.5 The following analytes will be analyzed for in the ICS solutions at the stated concentrations:

ICS-A Working Solution

Element	Concentration (ppm)
Al	100
Mo	20

ICS-AB Working Solution

Element	Concentration (ppm)
Al	100
As	0.02
Cr	0.02
Cu	0.02
Mn	0.02
Mo	2.0

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Ni	0.02
Se	0.02
Co	0.02
Ag	0.02
Cd	0.02

13.0 SAMPLE PREPARATION

13.1 Soil, sludge, and waste samples must be digested according to method 3050 prior to analysis. Please see the specific SOP for the detailed preparation procedure.

13.2 Samples that have had an extraction performed on them, such as TCLP, SPLP, EPTox, and ASTM, must first be extracted then be digested using method 3010 or 3015. Please see the specific SOP for the detailed preparation procedure.

13.3 Wastewater samples must be prepared using method 3010 or 3015. Please see the specific SOP for the detailed preparation procedure.

13.4 Oil samples may be digested using method 3051. Please see the specific SOP for the detailed preparation procedure.

13.5 Air samples are prepared using the digestion method specified by the method used in the collection of the samples.

13.6 Pure product samples are prepared according to the manufacturer, or according to a method developed by TriMatrix if available. Please see the specific SOP or dissolution procedure provided by the manufacturer or TriMatrix for the detailed preparation procedure.

14.0 CALIBRATION PROCEDURES

14.1 An initial calibration must be run prior to the analysis of any samples. This initial calibration must be performed daily, or once per every 24 hour analytical batch.

14.1.1 The initial calibration consists of an 8 point standard curve for silver and cadmium, and a minimum of a seven point calibration curve for all other analytes. The initial calibration curve consists of the standards prepared in 12.6. The silver and cadmium curve includes the 0.04 ppb standard. This concentration is not included when processing the curve for the other analytes. The 0 ppb is included as a standard in both curves.

14.1.2 The correlation coefficient must be greater than or equal to 0.995 for every analyte of interest. *If the coefficient is less than 0.995, contact the metals lab manager for assistance. All masses* which could affect data quality should be monitored to determine potential effects from matrix components on the analyte peak.

14.2 Initial Calibration Verification (ICV).

14.2.1 Immediately following the analysis of the curve, the analysis of an ICV is required. The ICV is a re-analysis of the high level 100 ppb standard prepared in 12.6.7, quantitated as a sample. The acceptance window for this QC is 90% to 110% recovery of the true value. If the ICV is not within the control limits, recalibrate the instrument and start again at step 14.2. If the ICV is still out of the control limits, see the metals lab manager.

14.3 Initial Calibration Blank (ICB)

14.3.1 After the analysis of the ICV, the analysis of an ICB is required. The ICB is a re-analysis of the 0 ppb standard prepared in 12.6.11, quantitated as a sample. The absolute value of the ICB reading must be less than the lowest reporting limit required for the analysis. If the ICB is not within the control limits, recalibrate the instrument and start again at step 14.2. If the ICB is still out of the control limits, see the metals lab manager.

14.4 Interference Check Solutions (ICS).

14.4.1 The interference check solutions were prepared to contain known concentrations of interfering elements that will demonstrate the magnitude of interferences and provide an adequate test of any corrections. The acceptance window for the interference check solution is 80% to 120%. If either one of the interference check solutions are outside of the control windows stop the analysis remake the out of control solution(s) and reanalyze. If the interference check solution(s) are now within the control windows continue the analysis. If either of the interference check solutions are still out of the control windows stop the analysis, correct the problem, and restart the analysis from the beginning.

14.5 Laboratory Control Sample (LCS).

14.5.1 A LCS must be analyzed to confirm the validity of the curve. The LCS is prepared from a stock dissimilar to that used to prepare initial calibration curve. The control windows for the LCS 90% to 110% recovery of the true values. If the percent recovery does not fall within the control windows, recalibrate the instrument and start the analysis at step 14.2.

14.6 Contract Required Detection Limit (CRDL)

14.6.1 Analyze a CRDL. This is a standard of known concentration at or near the low end of your calibration curve. There is no acceptance criteria for the CRDL other than it must be detected.

14.7 Analyze up to ten samples. A sample is defined as the average of three replicate readings of a solution that is not a standard. The following solutions would qualify as samples: LCSs, MPBs, LFBs, and spiked

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samples. The only solutions that are not considered samples are the ICV, ICS, ICB, CCB, CCV, and CCB solutions.

14.8 Continuing Calibration Verification (CCV)

14.8.1 Analyze the CCV. The CCV is a standard solution with a concentration of one half the highest standard solution used for the calibration. The acceptance window for this QC is 90% to 110% recovery of the true value. If the CCV is not within the control limits, recalibrate the instrument and start again at step 13.2. All samples since the last good ICV or CCV must be reanalyzed.

14.9 Continuing Calibration Blank (CCB)

14.9.1 Analyze the CCB. The CCB is the calibration blank and has the same acid concentration as the standards. The absolute value of the CCB reading must be less than the lowest reporting limit required for the analysis. If the CCB is not within the control limits, recalibrate the instrument and start again at step 13.2. All samples since the last good ICB or CCB must be reanalyzed.

14.10 Every twelve hours of instrument operation the ICS solutions must be analyzed to verify the magnitude of elemental and molecular ion isobaric interferences and the adequacy of any corrections. The acceptance window for this QC is 80% to 120% recovery of the true value. If the QC is not within the acceptance window for either ICS, stop the analysis, remake the interference check solution and reanalyze. If the QC is now within the acceptance window continue the analysis. If the QC is still outside the acceptance window stop the analysis, correct the problem, and restart the analysis from the beginning.

14.11 Repeat steps 14.7 through 14.9 until the end of the run.

14.12 The analytical batch must end with the analysis of an acceptable CCV and CCB. Again, the acceptance window for the CCV is 90% to 110% recovery of the true value, and the absolute value of the CCB reading must be less than the lowest reporting limit required for the analysis. If either is not within the control limits, recalibrate the instrument and start again at step 14.2. All samples since the last good CCV or CCB must be reanalyzed.

15.0 ANALYTICAL PROCEDURE

NOTE: The following section assumes that the user is familiar with the ELAN 6000 operating software. If you are unfamiliar or unsure, please consult the instrument manual for additional instruction. This procedure will provide adequate instruction for novices, but is not intended to replace the instrument operating manual.

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			Date Revised:	New
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15.1 Preliminary treatment of all matrices is always necessary because of the complexity of variability of sample matrices. Digestion procedures are presented in sample preparation methods (method 3005-3050/200.0/200.7). A minimum of five internal standards is always used.

15.2 Turn on the instrument.

15.2.1 Turn on the main power if it is not already on.

15.2.2 Turn on the Rf generator power if it is not already on.

15.2.3 Turn on the autosampler power if it is not already on.

15.2.4 Turn on the recirculator power if it is not already on.

15.2.5 Turn on the Ar gas supply if it is not already on.

15.2.6 Turn on the hood above the instrument if it is not already on.

15.3 Boot the computer and ELAN 6000 software.

15.3.1 If the computer is already on the ELAN software is running, skip to step 14.4. If you are unsure of the status of the computer, please see the metals manager.

15.3.2 Turn on the computer, monitor, and printer. If any of the devices fail to turn on, please see the metals manager.

15.3.3 When the computer boots, it will display:
Welcome
Press Ctrl + Alt + Del to log on.

15.3.4 The screen will display:
Welcome
username: Elan user
from: ICP-MS
password: ____
Just press enter do not enter anything as a password.

15.3.5 The screen will display:
Program manager and Elan 6000 (common)
move the arrow to Elan and click on it

15.3.6 The screen will display:
a general Elan 6000 window
move arrow to devices and click on it. This will bring up the pump page.

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15.4 Change the peristaltic pump tubing. Currently, three types of tubing are being used:

Black/Black	Sample line
Orange/Green	Internal standard line
Black/White	Waste line

The tubing should be changed for every run since the tension exerted on the tubing by the pump will cause the tubing to stretch. Place the waste line on the bottom so that the pump is pumping the waste away from the ICP. Place the internal standard line in the middle so that the pump is pumping the internal standard toward the ICP. Place the sample line on the top so that the pump is pushing the sample to the ICP. Update the instrument maintenance log to reflect that you change the pump tubing.

15.5 Click on the connect icon box then click on the ---> icon box this should turn the pump on in a counterclockwise direction. If the pump does not turn on. Click on the disconnect icon. Then click on the connect icon. Then click on the ---> icon and the pump should be turning in the counterclockwise direction. If the pump still is not on contact the metals lab manager.

15.6 Move the arrow to the instrument icon and click on it. There should be a picture of the ICP-MS and some of its components on the screen if there is not click on the front panel icon.

15.6.1 On the picture of the ICP-MS. There should be a number of components that are green and the status box should say Ready. Consult the instrument manual as to which components should be green.

15.6.2 If the status is Ready, move the arrow to the plasma icon box and click on start. The instrument will display an ignition icon bar until it has achieved a good plasma.

15.7 Once the plasma has been on for at least one half hour daily tuning of the instrument needs to be done.

15.7.1 Move the arrow to File. Highlight open workspace then click on x,y.wrk. This will align the plasma to the best spot on the sampler and skimmer cones. Place the sample tubing into a 10 ppb tuning solution of Rhodium, Lead, and Magnesium. Click on Analyze Sample and adjust the x,y knobs to get the highest Rhodium reading. This is typically 250,000 cps to 300,000 cps.

15.7.2 Next you will need to optimize the nebulizer flow and lens voltage. Move the arrow to File and highlight NLP.wrk. Place the sample line in the 10 ppb tuning solution and make sure that nebulizer flow is highlighted. Click on Analyze Sample. The computer will automatically adjust the nebulizer flow between 0.4 and 0.7 L/min. This range can be changed but has been found to be the best. When the instrument is finished go to File and click on Save.

15.7.3 Next highlight Lens Voltage and click on Analyze Sample. The computer will automatically pick the best lens voltage for you. The value is typically from 4 to 6 if it is not fix the problem

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and start the tuning procedure form 14.7.1. When the instrument is finished go to File and click on Save.

15.7.4 Next you will need to tune the mas spec. over the whole mass range. Go to File click on Open workspace. Click on Trimatrix Int.wrk. Place the internal standard line into the mixed internal standard bottle. Click on Tune Mass Spec. You want to get a value of 0.65 amu or less at 10% peak height. This has been shown by the instrument manufacturer to equal 1 amu peak width at 5% peak height. If the required resolution was not achieved. Manually adjust the DAC and try again, generally increasing it by 30 will decrease the Amu reading by 0.1. When the desired Amu reading has been achieved for all the referenced analytes then go to File and click on Save.

15.7.5 Next do a daily performance to see how the instrument is operating. Go to File and click on Daily.wrk. Place the sample probe into the 10 ppb tuning solution and click on Analyze Sample. The instrument will take a reading of certain masses and doubly charged ions and oxides. All % Rsd's should be less than 5% if not repeat the procedure once. If it is in the limits go to 14.7.6. If not stop the tuning procedure. Correct the problem and begin again for 14.7.1.

15.7.6 Next you will need to optimize the ion lens over the full mass range. Go to File and click on Open Workspace. Then Lens Optimization. Put the internal standard lime into the mixed internal standard bottle. Click on Clear Calibration. Then get analyte list, click on Optimize. The computer will automatically adjust the voltage to the ion lens finding the maximum value for each internal standard. When the optimization is done go to File and click on Save.

15.7.7 Once all of the optimization steps are complete you are ready to calibrate and run samples.

15.8 The table below lists the elements conditions in use at the time of this writing. Please note that any or all of the conditions listed below may change for an element without prior warning if it has been established that the new conditions are at least equivalent to those in the table.

Int Std	Analyte	Mass [amu]	Scan Mode	MCA Channels	Dwell Time per AMU [ms]	Integration Time [ms]	Corrections
Li		6.0151	Peak Hopping	1	100	1000	
	Be	9.0122	Peak Hopping	1	100	1000	
Sc		44.9559	Peak Hopping	1	100	1000	
	V	50.944	Peak Hopping	1	100	1000	ClO, Cr
	Cr	52.9407	Peak Hopping	1	100	1000	
	Mn	51.9405	Peak Hopping	1	100	1000	
	Co	58.9332	Peak Hopping	1	100	1000	
	+Ni	59.9332	Peak Hopping	1	100	1000	
	Ni	60.931	Peak Hopping	1	100	1000	
	+Cu	62.9298	Peak Hopping	1	100	1000	
	Cu	64.9278	Peak Hopping	1	100	1000	

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	+Zn	65.926	Peak Hopping	1	100	1000	
	Zn	66.9271	Peak Hopping	1	100	1000	
	Zn	67.9249	Peak Hopping	1	100	1000	
	As	74.9216	Peak Hopping	1	100	1000	ArCl, Se
	Se	81.9767	Peak Hopping	1	100	1000	
Ge		88.9054	Peak Hopping	1	100	1000	
	Mo	97.9055	Peak Hopping	1	100	1000	Ru
	+Ag	106.905	Peak Hopping	1	100	1000	
	Ag	108.905	Peak Hopping	1	100	1000	
	+Cd	110.904	Peak Hopping	1	100	1000	Mo, Pd
	Cd	113.904	Peak Hopping	1	100	1000	Sn
In		114.904	Peak Hopping	1	100	1000	Sn
	Sb	120.904	Peak Hopping	1	100	1000	
	+Sb	122.904	Peak Hopping	1	100	1000	Te
	Ba	134.906	Peak Hopping	1	100	1000	
	+Ba	136.905	Peak Hopping	1	100	1000	
Tb		158.925	Peak Hopping	1	100	1000	
	Tl	202.972	Peak Hopping	1	100	1000	
	+Tl	204.975	Peak Hopping	1	100	1000	
	Pb	207.977	Peak Hopping	1	100	1000	Pb, Pb
Bi		208.980	Peak Hopping	1	100	1000	
*	Br	208.980	Peak Hopping	1	0.1	1	
*	Cl	34.9689	Peak Hopping	1	0.1	1	
*	Ca	43.9555	Peak Hopping	1	0.1	1	
*	Mg	23.985	Peak Hopping	1	0.1	1	
*	Na	22.9898	Peak Hopping	1	0.1	1	
*	Fe	56.9354	Peak Hopping	1	0.1	1	
*	K	38.9637	Peak Hopping	1	0.1	1	
*	Ar Cl	76.9283	Peak Hopping	1	0.1	1	
*	Kr	82.9141	Peak Hopping	1	0.1	1	
*	Ru	100.906	Peak Hopping	1	0.1	1	
*	Pd	105.903	Peak Hopping	1	0.1	1	
*	Mo^{O}	107.901	Peak Hopping	1	0.1	1	
*	Sn	117.902	Peak Hopping	1	0.1	1	
*	Te	124.904	Peak Hopping	1	0.1	1	

* Used for reference purposes only
\+ Recommended Analytical Mass

15.8.1 The Table below lists the elemental equations being used at this time. Please note that any or all of these equations may change without prior warning if it has been established that the new equations are at least equivalent to those below:

Analyte	Equation
Al	$(1.00)(^{27}C)$
Sb	$(1.00)(^{123}C)$
Sb	$(1.00)(^{121}C)$
As	$(1.00)(^{75}C)-(3.127)[(^{77}C)-(0.815)(^{82}C)]$

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Ba	$(1.00)(^{137}C)$
Ba	$(1.00)(^{135}C)$
Be	$(1.00)(^{9}C)$
Cd	$(1.00)(^{111}C)-(1.073)[(^{108}C)-(0.712)(^{106}C)]$
Cd	$(1.00)(^{114}C)$
Cr	$(1.00)(^{52}C)$
Cr	$(1.00)(C)$
Co	$(1.00)(^{59}C)$
Cu	$(1.00)(^{63}C)$

15.9 Set up the analysis on paper using a sample identification weight sheet (ID/WT sheet). This sheet has columns where the operator enters the sample description, corresponding autosampler position number, digestion dilution (if any), and any subsequent dilutions performed on the sample. This sheet must be filled out before continuing with the procedure as it is an integral part of the analysis. Please see the group leader or metals lab manager if assistance is required in filling out this sheet.

15.9.1 Enter the method by moving the arrow to File and clicking on it. Then click on open workspace you will have a number of choices, but only choose between 200.8 Trimatrix.wrk, and Trimatrix soil.wrk.

15.9.2 Open a new data set. To do this move the arrow to the data set icon and click on it. Then move the arrow to file and click on it and choose new. You will need to enter a unique data file name. The current data file format is MDDAAAA-X,
where:
M = coded month
DD = two digit date of the month
AAAA = matrix that is running (i.e. soil, wtr, TCLP, WW)
X = Alpha representation of the number of runs that have been done under that matrix for that day (i.e. the first run would be 'a', the 5th run would be 'e').

15.9.3 Enter the sample list as identified on the ID/WT sheet. Please refer to the ELAN 6000 software manual for data entry procedures. When all the information is entered you will need to save the sample file. To do this go to file and click on save as. Use the same data file name here as you used for the data set.

15.10 Begin the analysis.

15.10.1 Make sure that batch is highlighted . Highlight the samples that you want to run and click on the analyze batch icon.

15.10.2 The computer will ask you a series of yes and no questions. If you are starting a new run answer yes to all of the questions. Then the computer will start the run.

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15.10.3 A measurement status box will be displayed on the screen at this time. It will tell you what the instrument is doing. It will also give you three options to stop a run at any time click on canal. To stop after the current sample click on stop scanning after current sample, or to skip the sample click on skip scanning of current sample.

15.10.4 If you have stopped a run for any reason and want to continue the analysis from where you left off go to 14.6.1.

15.11 When the analysis is completed, the autosampler will return to position 0 and wait for operator input.

15.12 Turn the raw data, ID/WT sheet, and report to the person who is to review the data for repeats, dilutions, etc.

16.0 CALCULATIONS AND DATA HANDLING

16.1 The concentration of each sample is read directly from the computer printout. Dilution factors should be taken into account in the ID weight file.

16.1.1 Assuming that the instrument did not correct a concentration due to analyst error, the following calculation would be used:

$C_{Final} = C_{Instr} * DF_{Digest} * DF_{Subseq}$, where:

C_{Final} = final reported concentration of the analyte
C_{Instr} = concentration as read from the instrument data printout
DF_{Digest} = digestion dilution factor
DF_{Subseq} = dilution due subsequent to the digestion dilution

16.2 All samples should be reported to the correct number of significant figures. The significant figure truncation should not be performed until all data calculation have taken place.

16.2.1 Solid samples must be reported in mg/kg.

16.2.1.1 For sample concentrations <100 ppm, report 2 significant figures.

16.2.1.2 For sample concentrations ≥ 100 ppm, report 3 significant figures.

16.2.1.3 For QC always report one additional significant figure.

16.2.2 Aqueous samples must be reported in ug/L.

16.2.2.1 For sample concentrations < 10 ppb, report 1 significant figure.

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16.2.2.2 For sample concentrations ≥ 10 ppb and < 1000 ppb, report 2 significant figures.

16.2.2.3 For sample concentrations ≥ 1000 ppb, report 3 significant figures.

16.2.2.4 For QC always report one additional significant figure.

16.2.3 Extracted samples for all metals must be reported in mg/L.

16.2.3.1 For sample concentrations <0.01 ppm, report 1 significant figure.

16.2.3.2 For sample concentrations ≥ 0.01 ppm and <1.00 ppm, report 2 significant figures.

16.2.3.3 For sample concentrations ≥ 1.00 ppm, report 3 significant figures.

16.2.3.4 For QC always report one additional significant figure.

17.0 DATA REPORTING AND DELIVERABLES

17.1 See appendices F, H, I, and J for data reporting.

18.0 QUALITY ASSURANCE

18.1 All quality control data should be maintained and available for easy reference or inspection.

18.2 Linear range studies must be performed every year or when there is a significant change in the instrument response.

18.2.1 To perform a linear range study, calibrate the instrument as it would be calibrated for an actual analysis.

18.2.2 Run standards at high concentrations and calculate the percent recovery for each element. A good place to start is 1 ppm.

18.2.3 If the percent recovery is acceptable (90%-110%), run a standard at a higher concentration. If the percent recovery is not acceptable, run a standard at a lower concentration.

18.2.4 The last standard concentration that had a percent recovery within the acceptance window will be designated as the linear range for that element.

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18.3 IDL/MDL studies must be performed on an annual basis.

18.3.1 Instrument Detection Limits (IDLs) in ug/L can be estimated by calculating the average of the standard deviation of the three runs on three non-consecutive days from the analysis of a reagent blank solution with seven consecutive measurements per day. Each measurement must be performed as though it were a separate analytical sample (i.e.. each measurement must be followed by a rinse and/or any other procedure normally performed between the analysis of separate samples).

18.3.2 To calculate an MDL, aspirate ten vials of a low concentration standard, typically at a concentration at or near the detection limit. Calculate the standard deviation of a small population and multiply the result by the Student's T value for (n-1) degrees of freedom. If the concentration of the standard ran is greater than ten times the calculated MDL, and the concentration of the standard ran is above the detection limit reported to clients, the MDL must be performed at lower concentration. If the standard concentration is less than ten times the calculated MDL or if the standard used for the analysis was at or below the lowest reporting limit on LIMS, the MDL is acceptable. There is also a spreadsheet located on the computer network that will perform this calculation for you. Please see the metals lab manager if you need assistance in using this program.

18.4 Dilute and reanalyze samples that are more concentrated than the established linear range.

18.5 Include a minimum of one laboratory blank per sample batch to determine if contamination or any memory effects are occurring. This laboratory blank must be carried through the sample preparation procedure.

18.6 Analyze one matrix spike (MS) and one matrix spike duplicate (MSD) at a frequency of at least 1 in 20 (5%). MS and MSDs are aliquots of sample into which a known quantity of analyte is pipetted in. The percent recovery of the analyte is calculated. This measures the accuracy of the sample preparation method as well as the effect of the matrix on the analysis. The relative percent difference is calculated from the MS and MSD concentrations. The MSD checks the precision of the method. The percent recoveries should be between 70 percent and 130 percent of the spiked value.

18.6.1 Pretreated samples must be spiked at the time of digestion before the digestion has begun. Please see the specific pretreatment procedure for a discussion on spiking procedures.

18.6.2 Samples that require dilutions that have an MS/MSD performed on them must also have an MS/MSD performed on an aliquot of dilution.

18.6.3 Samples not requiring pretreatment are spiked before they are physically loaded on the tray.

18.6.3.1 See Appendix A for the method used to spike samples.

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18.6.3.2 If the method in Appendix A is followed when spiking you should get 40 ug/L as a final concentration.

18.6.4 Calculate the percent recovery of the MS and MSD as follows.

$$\%R = \frac{C_{Spike} - C_{Orig}}{\text{Spike Quantity}} * 100$$

where:

%R = percent recovery of the spike
C_{Spike} = concentration of the spiked sample
C_{Orig} = original concentration of the sample (the unspiked sample concentration)
Spike Quantity = quantity of the element spiked into the sample

18.6.5 Calculate the relative percent difference between the MS and MSD as follows:

$$\%RPD = \frac{C_{MSD} - C_{MS}}{(C_{MSD} + C_{MS})/2} * 100$$

where:

%RPD = relative percent difference between the MS and MSD
C_{MSD} = concentration of the MSD as read from the raw data printout
C_{MS} = concentration of the MS as read from the raw data printout

18.7 It is recommended that whenever a new or unusual sample matrix is encountered, a series of tests be performed prior to reporting concentration data for analyte elements. These tests, as outlined in 18.7.1 through 18.7.3, will ensure the analyst that neither positive nor negative interferences are operating on any of the analytes to distort the accuracy of the reported values.

18.7.1 **Serial dilution:** If the analyte concentration is sufficiently high (minimally, a factor of 10 above the instrument detection limit after dilution), an analysis of 5X dilution must agree within 10% of the original determination. If not, a chemical physical interference effect should be suspected. And standard addition must be performed.

18.7.2 **Matrix spike addition:** An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered within 75% to 125% of the known value. The spike addition should produce a minor level of 10 times and a maximum of 100 times the instrumental detection limit. If the spike is not recovered within the specific limit, matrix effect should be suspected. The use of a standard-addition analysis procedure can usually compensate for this effect.

18.7.3 **Standard addition:** The standard-addition technique involves adding known amounts of standard to one or more aliquots of the process sample solution. This technique compensates for a sample constitute that enhances or depresses the analyte signal, thus producing a different

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slope from that of the calibration standards. It will not correct additive interferences which could a baseline shift. The simple version of this technique is the single addition method, in which identical aliquots of the sample solution, each of volume V_X, are taken. To the first (labeled A) is added a small volume V_S of a standard solution of concentration C_S. To the second (labeled B) is added the same volume V_S of the solvent. The analytical signals of A and B are measured and corrected for nonanalyte signals. The unknown sample concentration C_X is calculated:

$$C_X = \frac{S_B * V_S * C_S}{(S_A - S_B) * V_X}$$

where S_A and S_B are the analytical signals (corrected for the blank) of solutions A and B, respectively. V_S and C_S should be chosen so that S_A is roughly twice S_B on the average. It is best if V_S is made much less than V_X, and thus C_S is must greater than C_X, to avoid excess dilution of the sample matrix. If a separation or concentration step is used, the additions are best made first and carried through the entire procedure. For the results of this technique to be valid, the following limitations must be taken into consideration:

1. The analytical curve must be linear.
2. The chemical form of the analyte added must respond the same way as the analyte in the sample.
3. The interference effect must be constant over the working range of concern.
4. the signal must be corrected for any additive interference.

The intensity of each solution is determined and then plotted on the vertical axis of a graph, with the concentrations of known standards plotted on the horizontal axis. When the resulting line is extrapolated back to zero absorbance, the point of interception of the abscissa is the concentration of the unknown. The abscissa on the left of the ordinate is scaled the same as on the right side, but in the opposite direction from the ordinate.

NOTE: A method of standard addition must be performed on any TCLP sample whose spike recovery is not greater than 50%.

18.8 Check the instrument standardization by analyzing appropriate quality control check standards as follows:

NOTE: Steps 18.8.2 through 18.8.6 must be performed every time the instrument is calibrated.

18.8.1 Calibrate the instrument using a standard and a blank.

18.8.2 An ICS/ICV (Initial Calibration Standard/Initial Calibration Verification) is placed after the calibration standards and blank. Percent recovery limits are 90% to 110% of the original calibration standard concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis.

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18.8.3 An ICB/CCB (Initial Calibration Blank/continuing Calibration Blank) is analyzed after the ICV. The results of this blank are to be within ± the detection limit. If the blank is not within ± the detection limit for an element that must be analyzed, terminate the analysis, correct the problem and restart the analysis from the beginning.

18.8.4 The interference check solutions is analyzed at the beginning and end of each run and every 12 hours of instrument operation. This standard is analyzed to demonstrate the magnitude of interferences and provide an adequate test of any corrections. Percent recovery limits are 80% to 120% of the actual concentration. If the percent recovery for this standard is not within acceptance limits. Stop the run remake the standard and reanalyze. If it is now within limits continue the analysis stop the run remake the standard and reanalyze. If it is now within limits continue the analysis. If the standard is still outside of the acceptance limits stop the run, correct the problem, and restart the analysis from the beginning.

18.8.5 An LCS (Laboratory Check Standard), which must come from a different primary source than the calibration standards, is placed after the first CCV in each run. Percent recovery limits are 80% to 120% of the concentration unless control limits have been established. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the beginning. See the following table for a tabulation of the LCS concentrations as of this writing. Dashes in the table indicate that the element to the left is not present in the solution.

LCS Concentration When Diluted According to Instructions

Element	SP1036 (ug/L)	SP1037 (ug/L)	ERA 9965
Aluminum	80	---	59.3
Antimony	---	80	11.1
Arsenic	80	---	5.19
Barium	80	---	29.6
Beryllium	80	---	8.89
Cadmium	80	---	8.15
Chromium	80	---	23.0
Cobalt	80	---	55.6
Copper	80	---	44.8
Lead	80	---	43.0
Manganese	80	---	16.3
Molybdenum	---	80	20.7
Nickel	80	---	31.9
Selenium	80	---	17.8
Silver	80	---	8.89
Thallium	80	---	5.19
Vanadium	80	---	11.7
Zinc	80	---	47.4

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18.8.6 Verify the calibration after every 10 samples.

18.8.6.1 A CCV (Continuing Calibration Verification) is analyzed after every 10 samples, or sooner. Percent recovery limits are 90% to 1110% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCV or ICS/ICV.

18.8.6.2 A CCB (Continuing Calibration Blank) is analyzed after the CCV. The results of this blank are to be within ± the detection limit. If the blank is not within ± the detection limit for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCB or ICB/CCB.

18.8.7 At the end of each run, verify the calibration.

18.8.7.1 A CCV (Continuing Calibration Verification) is analyzed at the end of each run. Percent recovery limits are 90% to 110% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCV or ICS/ICV.

18.8.7.2 A CCB (Continuing Calibration Blank) is analyzed after the CCV. The results of this blank are to be within ± the detection limit. If the blank is not within ± the detection limit for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCB or ICB/CCB.

18.8.7.3 An interference check solution is analyzed at the end of the run. This standard is analyzed to demonstrate the magnitude of interferences and to provide an adequate test of any collections. Percent recovery limits are 80% to 120%. If the percent recovery is not within acceptance limits: Stop the run, remake the standard, and reanalyze. If it i now within limits continue the analysis. If it is still outside of the acceptance limits, stop the run, correct the problem, and restart the analysis from the beginning.

19.0 ANALYST CERTIFICATION/METHOD VALIDATION

19.1 Please see section 3.8.3 and 3.9.3.2 of the TriMatrix Quality Assurance Manual and Appendix E for analyst and method certification/validation protocols.

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20.0 REFERENCES

20.1 ELAN 6000 Software Guide; Perkin Elmer Corporation; Manual 0993-8965, Release E, June 1995.

20.2 - ELAN 6000 Hardware Guide; Perkin Elmer Corporation; Manual 0993-8969, Release D; September 1995.

21.0 ATTACHMENTS/APPENDICES

21.0 See Attached

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STANDARD OPERATING PROCEDURE

Inductively Coupled Plasma Atomic Emission Spectroscopy Perkin Elmer OPTIMA-3000

USEPA METHODS 200.7/6010A

APPROVALS:

Metals Supervisor: Betty J. Doyle Date: 4/4/96

QA/QC Supervisor: Scott Tent Date: 4-4-96

Laboratory Manager: Date: 4/4/96

Procedure Number: GR-01-100

Revision Number: 1.2 By: Betty Doyle Effective Date: 4/4/96

Total Number of Pages: 65 Pages Revised: All

20.3 USEPA SW846, Method 3010A Revision 1, July 1992

21.0 APPENDIX

See Attachments.

TriMatrix Laboratories, Inc.

STANDARD OPERATING PROCEDURE

ACID DIGESTION OF SOLID WASTE, SLUDGES, AND SOILS FOR FLAME ATOMIC ABSORPTION, INDUCTIVELY COUPLED PLASMA, OR FURNACE ATOMIC ABSORPTION

USEPA METHOD 3050A, MODIFIED

APPROVALS:

Metals Supervisor: Betty Doyle Date: 2/1/96

QA/QC Supervisor: Scott Test Date: 2-1-96

Laboratory Manager: [signature] Date: 2-1-96

Procedure Number: GR-01-103

Revision Number: 1.0 By: Betty Doyle Effective Date: 2/1/96

Total Number of Pages: 10 Pages Revised: All

1.0 METHOD REFERENCE

SW846, November 1986 Third Edition.
USEPA Method 3050A Revision 1
Date July 1992

2.0 PARAMETER LIST

FLAA or ICP		GFAA
Aluminum	Molybdenum	Arsenic
Arsenic [1,2]	Nickel	Beryllium
Barium	Osmium	Cadmium
Beryllium	Phosphorus [1,2]	Chromium
Boron [1,2]	Potassium	Cobalt
Cadmium	Selenium [1,2]	Iron
Calcium	Silicon [1,2]	Lead
Chromium	Silver	Molybdenum
Cobalt	Sodium	Selenium
Copper	Strontium [1,2]	Silver
Iron	Thallium	Thallium
Lead	Tin [1,2]	Vanadium
Lithium [1,2]	Titanium [1,2]	
Magnesium	Vanadium	
Manganese	Zinc	

1 This analyte is not covered for digestion in SW-846. It's inclusion in this procedure is due to clients' request for this metal.
2 This metal may only be analyzed by ICP.

3.0 SCOPE AND APPLICATION

This method is an acid digestion procedure used to prepare sludges, solid waste, and soil samples for analysis by flame atomic absorption (FLAA), inductively coupled plasma (ICP), or by graphite furnace atomic absorption (GFAA) as indicated by Section 2.0.

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4.0 SUMMARY OF METHOD

A representative sample is digested in nitric acid and hydrogen peroxide. The digestate is then refluxed with hydrochloric acid if the digestate is to be analyzed by FLAA or ICP. If the digestate is to be analyzed for GFAA, then the sample is refluxed with nitric acid. The final digestate is then filtered and diluted to a predetermined volume.

5.0 INTERFERENCES AND CORRECTIVE PROCEDURES

5.1 Silver precipitation can be avoided by adding an excess of HCl.

5.2 This digestion may not be applicable to all types of solid waste material due to insolubility in the acids and/or water. If the sample superheats during the digestion procedure, an alternative method may have to be used (such as USEPA 3051).

5.3 This digestion will not totally dissolve most matrices. If a total dissolution procedure is required for the sample, the analyst should seek the advise of the metals lab supervisor.

5.4 Contamination is always a major consideration in the analysis of metals. Make sure that the preparation area is free of dust, dirt, etc. before beginning this procedure.

6.0 SAFETY PRECAUTIONS

6.1 The analyst must comply with all standard operating procedures for health and safety as outlined in the "TriMatrix Laboratory Safety Manual".

6.2 Concentrated acids are used in the preparation of standards and samples for analysis by cold vapor. Gloves and safety glasses must be worn at all times when handling concentrated acids. Gloves must also be worn when handling digested samples. Please refer to the MSDSs for information on these or any other chemicals utilized in this procedure.

6.3 Check the exhaust hood to be sure it is operating correctly. If the ventilation system is not working properly, immediately contact the metals lab supervisor. Under no circumstances should this procedure be performed without adequate ventilation.

6.4 No food or drink is allowed in the metals lab. Food or drink may become contaminated with acid or metals and may therefore be hazardous.

6.5 Wash hands before starting work. Chemicals may be present on the skin which may interfere with metals analysis. Wash hands before leaving the metals lab. Chemicals and acids may be on the skin which could eventually be ingested or passed on to a third party through casual contact.

7.0 SAMPLE SIZE, COLLECTION, PRESERVATION AND HANDLING PROCEDURES

To ensure enough sample for QC and/or repeats collect at least 30 grams of material to be tested. Sample preservation is not required. Samples must be digested and analyzed within 180 days of collection.

8.0 APPARATUS

8.1 Eppendorf Pipettor (capable of delivering 500 ul).

8.2 Adjustable pump-type dispenser capable of dispensing 1.5 ml of reagent. This pump is for the concentrated HNO_3.

8.3 Adjustable pump-type dispenser capable of dispensing 5.0 ml of reagent. This pump is for the 1:1 HCl.

8.4 Corning hot Plates. Model #PC-500.

8.5 Griffin beakers (identified for 3050-soils).

8.6 Ribbed watch glasses.

8.7 Class A volumetric flasks.

8.8 Whatman 41 filter paper.

8.9 Plastic funnels.

8.10 Plastic specimen containers.

8.11 Balance (capable of weighing to 0.01 grams).

8.12 Graduated cylinder (10 ml).

8.13 Spatulas.

8.14 Glass thermometers capable of reading 95*C.

9.0 ROUTINE PREVENTIVE MAINTENANCE

9.1 Calibrate all pipettors once per week.

9.2 Clean hot plates and counters daily.

10.0 CHEMICALS AND REAGENTS

10.1 Deionized/Distilled water (ASTM Type II).

10.2 Concentrated nitric acid, trace metal grade (HNO_3).

10.3 Concentrated hydrochloric acid, trace metal grade (HCl).

10.4 Hydrogen peroxide (30%) (H_2O_2).

10.4 Milli-Q water (ASTM Type I).

10.5 1:1 HNO_3 for cleaning filters. Into 500 ml ASTM Type II water, place 500 ml concentrated HNO_3. Always use a suitable container capable of withstanding the heat generated by the exothermic dilution of the acid.. Always add acid to water (failure to do so could result in a violent explosion of acid as the water boils).

11.0 STANDARDS

11.1 FLAA/ICP spiking solutions (see Appendix A).

11.2 GFAA spiking solutions. 10,000 ppb single-element furnace standards are used for this procedure. Please refer to Appendix B for standard preparation.

12.0 SAMPLE PREPARATION

12.1 Determine whether samples need to be digested for ICP/FLAA or GFAA.

12.2 Run a pretreatment benchsheet to determine analyses needed (see Appendix F).

12.3 Dry and grind the samples(see Appendix M).

12.4 Label a 150 ml griffin beaker with the sample number, client name, and any dilution information that is pertinent.

12.5 We must perform 5% matrix spikes and matrix spike duplicates. If this sample has been designated as needing matrix QC (MS/MSD), then repeat step 12.4 with two more aliquots of the sample. Label the first aliquot's beaker with "SPK", and the second one as "MSD".

12.6 Repeat steps 12.4 through 12.5 until there are 20 samples in the batch, or until there are no more samples to be prepared.

12.7 Label 1 beaker as MPB (method preparation blank) and 1 beaker as LFB (laboratory fortified blank). Set aside for now.

12.8 Weigh out the samples.

12.8.1 For FLAA/ICP, weigh 2.50 grams of each remaining sample into 150 ml soil beakers. Record the weight to the nearest 0.01 g. If this sample has been designated for matrix QC, then weigh approximately 10 grams of the mixed sample into a weigh boat and mix again. From the weigh boat, weigh 2.50 g into each of 3-150 ml soil beakers. Record the exact weight to the nearest 0.01 g.

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12.8.2 For GFAA, weigh 0.40 grams of each remaining sample into 150 ml soil beakers. Record the weight to the nearest 0.01 g. If this sample has been designated for matrix QC, then weigh approximately 5 grams of the mixed sample into a weigh boat and mix again. From the weigh boat, weigh 0.40 g into each of 3-150 ml soil beakers. Record the exact weight to the nearest 0.01 g.

12.9 Repeat step 12.8 until there are 20 samples in the batch or until there are no more samples to be prepared.

12.10 For ICP/FLAA, add 10 ml of ASTM Type II water to all the beakers, including the MPB and LFB. For GFAA, add 5 ml of ASTM Type II water to all the beakers, including the MPB and LFB.

12.11 All of the samples labeled as SPK, MSD, or LFB must be spiked appropriately before digestion.

12.11.1 For ICP/FLAA, see Appendix A. The final solution volume will be 50 ml.

12.11.2 For GFAA, see Appendix B. The final volume will be 50 ml.

12.12 Add the nitric acid (HNO_3).

12.12.1 For ICP/FLAA, add 10 ml of trace metal HNO_3, cover with a ribbed watch glass. Heat the samples to 95°C and reflux for 15 minutes. Do not allow samples to boil or go dry.

12.12.2 For GFAA, add 5 ml of trace metal HNO_3, cover with a ribbed watch glass. Heat the samples to 95°C and reflux for 15 minutes. Do not allow samples to boil or go dry.

12.13 Allow the sample to cool. Repeat Step 12.12, refluxing for 30 minutes this time. Do not allow samples to boil or go dry.

12.14 Repeat Step 12.13 t ensure complete oxidation of the sample.

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1.0 PRINCIPAL METHOD REFERENCE

1.1 SW846, November 1986 Third Edition
USEPA Method 6010A Revision 1
Date July, 1992

Method for Chemical Analysis of Water and Wastes
Revised March 1983
USEPA Method 200.7

Code of Federal Regulations
40 CFR Pt. 136, Appendix C

2.0 PARAMETER LIST

This method may be used for the analysis of the following metals.

Aluminum	Molybdenum
Antimony	Nickel
Arsenic	Phosphorus
Barium	Potassium
Beryllium	Scandium
Boron	Selenium
Cadmium	Silicon
Calcium	Silver
Chromium	Sodium
Cobalt	Strontium
Copper	Thallium
Iron	Tin
Lead	Titanium
Lithium	Vanadium
Magnesium	Zinc
Manganese	

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3.0 SCOPE AND APPLICATION

3.1 Inductively coupled plasma atomic emission spectroscopy (ICP) determines a wide range of elements in solution. The method is applicable to a large number of metals in a large variety of matrices including, but not limited to soil, water, drinking water, wastewater, TCLP extracts, EPTox extracts, SPLP extracts, ASTM extracts, oil, solvents, paint, sludge, air, pure products, or any other matrix that may be extracted or dissolved into an acidic aqueous matrix. Most matrices require solubilization or digestion prior to analysis.

4.0 SUMMARY OF TEST METHOD

4.1 Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods. See Methods 3005-3050/200.0/200.7.

4.2 This method describes the simultaneous, multi-elemental determination of elements by ICP. The method measures element-emitted light by optical spectrometry. Samples are nebulized and the resulting aerosol is transported to the Ar plasma torch via an Ar carrier gas. Element-specific atomic-line emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by an eschelle grating polychromater, and the intensities are monitored by a segmented charge coupled device (SCD). See Table 1 for current wavelength and detection limit data. The wavelengths listed in Table 1 are selected because of their sensitivity and overall acceptance. Other wavelengths may be substituted if they can provide the needed sensitivity and are treated with the same corrective techniques for spectral interference. The listed wavelengths may change at any time without warning if it is proven that another line will provide the necessary sensitivity and freedom from spectral interferences. In time, other elements may be added as more information becomes available and as required. The estimated instrumental detection limits shown in Table 1 are calculated as $3(\sigma_{n-1})$ from a detection limit study. The actual method detection limits are sample dependent and may vary as the sample matrix varies. Scandium (Sc) is used as an internal standard and is not of interest at its detection limit. Arsenic data was not available at the time of this printing. Background correction is required for trace element determination. Background intensities must be measured adjacent to analyte lines on samples during analysis. The position selected for the background intensity must be free from spectral interferences and reflect the same change in background intensity that occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result.

Table 1
ANALYTICAL WAVELENGTHS AND
INSTRUMENTAL DETECTION LIMITS FOR OPTIMA 3000

Element	Elemental Symbol	Wavelength (nm)	Instrument Detection Limit (ug/L)
Aluminum	Al	396.140	7.4
Antimony	Sb	206.831	52
Arsenic	As	193.694	48
Barium	Ba	455.403	0.99
Beryllium	Be	234.861	0.12
Boron	B	249.773	4.7
Cadmium	Cd	214.438	1.9
Calcium	Ca	315.887	8
Chromium	Cr	205.558	3.5
Cobalt	Co	238.890	3.5
Copper	Cu	324.764	1.5
Iron	Fe	238.204	8.4
Lead	Pb	220.353	21
Lithium	Li	670.781	0.80
Magnesium	Mg	279.074	22
Manganese	Mn	257.610	0.70
Molybdenum	Mo	202.031	8.2
Nickel	Ni	231.603	5.2
Phosphorus	P	213.618	49
Potassium	K	766.514	41
Scandium	Sc	357.253	N/A
Selenium	Se	196.026	<200
Silicon	Si	251.611	10
Silver	Ag	328.065	0.6
Sodium	Na	588.995	36
Strontium	Sr	407.771	0.18
Thallium	Tl	190.794	38
Tin	Sn	189.930	24
Titanium	Ti	334.941	7.5
Vanadium	V	292.402	3.8
Zinc	Zn	213.858	0.6

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5.0 INTERFERENCES

5.1 **Spectral interferences** are caused by: (1) overlap of a spectral line from another element; (2) unresolved overlap of molecular band spectra; (3) background contribution from continuous or recombination phenomena; and (4) stray light from the line emission of high-concentration elements. Spectral overlap can be compensated for by computer-correcting the raw data after monitoring and measuring the interfering element. Unresolved overlap requires selection of an alternate wavelength. Background contribution and stray light can usually be compensated for by a background correction adjacent to the analyte line.

Users of simultaneous multi-element instruments, such as the Optima 3000, must verify the absence of spectral interference at the analytical wavelength. Table 2 shows the interferences that have been documented at the time of this writing for the Optima 3000. The data in Table 2 are intended as rudimentary guides for indicating potential interferences. This data will periodically change without warning as these values are only guides. For current interelement correction factors, please see the instrument operator.

5.1.1 The interference is expressed as analyte emission equivalents (i.e., false analyte emissions) arising from 1 emission count of the interfering element. The Optima 3000 software automatically calculates and compensates for interelement corrections (IEC). For more information on the topic of interelement corrections and how the Optima 3000 handles them, please see the Optima 3000 software manual.

5.1.2 The dashes in Table 2 indicate that no measurable interferences were observed at the concentrations used to create this table.

Table 2
ANALYTE EMISSION EQUIVALENTS ARISING FROM INTERFERENCE FOR THE OPTIMA 3000
INSTRUMENT 101

Analyte	λ	Al	B	Be	Ca	Cd	Co	Cu	Fe	K	Li	Mg	Mn
Ag	328.065	0.000050	0.000010	-0.000002	-0.000186	-0.000009	-0.000026	-0.000001	-0.000841	-0.000002	---	-0.000914	0.000056
Al	396.140	N/A	0.000015	---	0.000001	0.000015	0.000002	0.000001	-0.000141	0.000005	-0.000001	0.000034	---
As	193.691	-0.000015	-0.000003	---	-0.000001	0.000026	0.000022	-0.000002	-0.000010	---	---	-0.000014	-0.000001
B	249.773	0.000017	N/A	0.000013	0.000026	0.001253	-0.000094	---	0.002218	0.000008	0.000001	-0.000027	0.000031
Ba	455.403	0.000103	-0.000139	0.000081	0.000055	0.000177	0.008286	0.000013	0.000129	0.000177	0.000015	0.000229	0.000014
Be	234.861	0.000260	0.000012	N/A	0.000001	0.000017	0.000153	0.000003	0.001322	0.000158	0.000005	-0.000152	-0.000008
Ca	315.887	0.000016	-0.000116	-0.000011	N/A	-0.000159	0.008221	0.000016	0.000261	-0.000099	-0.000011	0.000794	0.000019
Cd	214.438	0.000113	-0.000001	-0.000038	0.000001	N/A	0.000053	0.000022	0.000109	0.000001	---	0.000145	0.000001
Co	238.890	---	-0.000061	0.000002	-0.000005	-0.000046	N/A	---	0.001418	0.000003	---	0.000006	0.000001
Cu	324.764	0.000025	0.000061	0.000013	-0.000030	0.000011	0.000196	N/A	0.001169	0.000014	0.000005	0.005583	0.000011
Fe	238.204	0.000017	0.000025	0.000001	0.000008	0.000009	0.000098	0.000012	N/A	0.000007	0.000001	0.000196	0.000024
K	766.514	0.000021	0.000098	0.000001	0.000010	0.000017	-0.000066	0.000012	0.000770	N/A	0.000014	0.000108	0.000010
Li	670.781	0.000018	0.000138	-0.000003	-0.000051	0.000251	0.000012	-0.000009	0.000619	0.000028	N/A	0.001026	-0.000007
Mg	279.074	0.000006	0.000005	-0.000001	-0.000026	-0.000001	-0.000183	---	0.000100	-0.000002	---	N/A	0.000053
Mn	257.610	0.000145	-0.000031	0.000001	0.000016	-0.000015	0.000053	0.000001	-0.000116	0.000011	---	0.001103	N/A
Mo	202.031	-0.000007	0.000002	---	-0.000002	---	-0.000005	0.000005	-0.000005	---	---	0.000005	---
Na	588.995	0.000530	0.002112	0.000179	0.000310	0.002318	0.002388	0.000069	0.002195	0.000726	0.000111	0.001083	0.000116
P	213.618	0.000008	-0.000006	---	-0.000005	-0.000001	-0.000004	0.000202	-0.000018	-0.000002	---	0.000011	-0.000001
Sb	206.831	-0.000027	0.000005	---	-0.000002	-0.000005	0.000006	-0.000002	-0.000008	---	---	0.000019	-0.000002
Sc	357.253	0.000268	-0.000450	-0.000056	0.000136	-0.000875	-0.001421	-0.000010	-0.000510	-0.000126	-0.000023	0.001730	0.000001
Se	196.026	-0.000001	-0.000010	---	0.000001	0.000002	-0.000019	---	-0.000022	---	---	-0.000006	---
Si	251.611	0.000554	-0.000130	-0.000009	0.000119	-0.000278	-0.000358	0.000028	-0.000091	-0.000055	-0.000006	0.009011	0.000015
Sr	407.771	0.000007	0.000227	0.000002	0.000871	0.000242	-0.001019	0.000002	-0.000223	0.000010	0.000292	-0.000003	0.000002
Ti	334.941	0.000092	0.000081	0.000006	-0.000124	0.000159	0.000752	0.000102	0.000262	0.000028	0.000003	0.001618	0.000007
V	292.402	-0.000012	0.000028	-0.000013	0.000002	0.000028	0.000019	0.000001	0.000101	0.000003	0.000001	0.000052	0.000004
Pb	220.353	0.000002	-0.000003	-0.000006	0.000003	-0.000008	0.000072	0.000005	-0.000011	---	---	-0.000062	-0.000001
Ni	231.603	-0.000011	0.000007	---	---	0.000023	0.001143	-0.000002	-0.000007	---	---	-0.000046	---
Cr	205.558	0.000005	0.000007	-0.000535	0.000001	0.000010	0.000020	-0.000001	0.000010	---	---	-0.000014	-0.000003
Zn	213.858	0.000035	0.000020	-0.000005	0.001138	0.000076	0.000062	0.000194	0.000146	0.000008	0.000002	0.000019	0.000006
Sn	189.930	-0.000005	0.000003	---	0.000029	-0.000005	0.000009	-0.000001	-0.000020	0.000001	---	0.002130	-0.000004
Tl	190.794	0.000066	-0.000131	-0.000001	0.000026	-0.000210	-0.000102	-0.000001	-0.000557	-0.000030	-0.000004	-0.000844	0.000007

Approved By: SJ 4-4-96
QA/QC Supervisor

Approved By: GJD 4-4-96
Area Supervisor

Table 2 continued
ANALYTE EMISSION EQUIVALENTS ARISING FROM INTERFERENCE FOR THE OPTIMA 3000
INSTRUMENT 101

Analyte	λ	Mo	P	Sb	Sc	Se	Ti	V	Pb	Ni	Cr	Ag	Tl
Ag	328.065	0.001737	0.000341	0.000106	0.000030	0.001611	0.000045	0.000229	0.003710	-0.000024	-0.000049	-0.000243	0.000172
Al	396.140	0.050458	0.000335	0.000426	-0.000006	0.000179	0.000017	0.000036	0.000070	-0.000520	0.000060	-0.000001	-0.000035
As	193.694	0.000032	-0.000084	-0.000118	-0.000004	0.000177	---	0.000015	0.000062	0.000026	0.000140	0.000002	---
B	249.773	-0.000677	0.000744	0.000266	-0.000004	0.044662	0.000010	-0.000148	0.016232	0.000263	-0.000138	0.000372	0.047492
Ba	455.403	0.004130	0.019290	0.007999	0.000193	0.001338	-0.000023	0.000194	0.003324	0.000472	0.000780	0.000004	0.000881
Be	234.861	-0.005137	0.005041	0.001900	-0.000008	0.001585	0.000007	-0.000001	0.000537	0.000059	-0.001748	0.000006	0.000281
Ca	315.887	0.010015	-0.005816	-0.004457	0.000089	-0.018792	0.000036	-0.003852	-0.005777	0.000046	-0.001528	-0.000099	-0.003067
Cd	214.438	-0.000123	0.000197	0.000387	-0.000004	0.000335	---	-0.000051	0.000228	0.000817	-0.000039	0.000021	0.000032
Co	238.890	0.000090	0.000323	-0.000024	0.000004	0.000070	---	0.000246	0.001663	-0.000037	-0.000054	-0.000003	0.000043
Cu	324.764	0.022074	0.001118	0.000404	0.000076	0.003799	-0.000125	0.000038	0.000981	0.005341	0.000108	0.000014	0.000200
Fe	238.204	0.000118	0.001063	0.001195	0.000007	0.001845	0.000165	-0.001028	0.000438	0.000094	0.004045	0.000007	0.000276
K	766.514	0.002393	0.011369	0.002821	0.000143	0.006884	0.000014	0.000286	0.000204	0.000179	-0.000065	0.000014	0.000156
Li	670.781	-0.000933	0.002374	0.010223	-0.000068	0.006715	-0.000005	0.000108	0.001937	-0.000191	-0.000305	0.000041	0.001957
Mg	279.074	0.000157	-0.000098	0.000029	-0.000004	-0.000059	0.000028	0.000041	-0.000072	-0.000038	-0.000112	-0.000003	-0.000070
Mn	257.610	-0.000385	-0.000633	-0.000299	0.000002	-0.000978	0.000047	-0.000066	-0.000433	0.001016	0.002430	-0.000003	-0.000190
Mo	202.031	N/A	0.000052	0.000011	0.000001	-0.000038	0.000001	0.000004	0.000025	0.000074	0.001457	---	0.000014
Na	588.995	0.003140	0.053565	0.044226	0.000513	0.101270	0.000033	0.000344	0.027038	0.001390	0.002427	0.000416	0.014623
P	213.618	0.001570	N/A	-0.000099	0.000003	-0.000127	-0.000001	0.000002	-0.000166	0.000112	0.000037	-0.000002	-0.000048
Sb	206.831	0.001094	-0.000108	N/A	-0.000070	0.000026	---	0.000001	-0.000033	0.000093	0.001717	---	0.000061
Sc	357.253	0.003392	-0.015891	-0.009545	N/A	-0.030062	-0.000006	0.000634	0.009755	-0.002416	-0.000594	-0.000137	-0.004557
Se	196.026	0.000015	0.000109	0.000032	-0.000002	N/A	---	---	0.000018	0.000004	0.000014	---	0.000009
Si	251.611	0.017841	-0.007392	-0.004843	0.000492	-0.010804	0.000385	0.000471	-0.004126	0.000438	0.000570	-0.000045	-0.001029
Sr	407.771	0.001288	0.002436	0.096894	0.000113	0.007340	-0.000041	0.000046	0.003409	0.000069	0.002546	0.000037	0.004749
Ti	334.941	0.001154	0.002839	0.002701	0.000386	0.005029	N/A	0.002462	0.001298	0.000036	0.011714	0.000027	0.000660
V	292.402	-0.016818	0.000583	0.000402	0.000101	0.001176	0.000049	N/A	0.000325	0.000067	0.001418	0.000003	0.000099
Pb	220.353	-0.001211	-0.000046	-0.000153	0.000007	0.001118	-0.000008	-0.000010	N/A	0.000046	-0.000004	---	-0.000034
Ni	231.603	-0.000540	0.000047	0.001160	0.000003	-0.000118	0.000003	-0.000009	0.000001	N/A	-0.000047	---	0.002266
Cr	205.558	0.000666	0.000083	0.000052	0.000002	0.000532	0.000014	0.000012	0.000068	0.000925	N/A	0.000002	0.000062
Zn	213.858	-0.000080	0.001070	0.000971	0.000004	0.003067	0.000006	0.000086	0.000838	0.010323	0.000151	0.000017	0.000464
Sn	189.930	-0.000047	0.000181	0.000122	0.000005	0.000463	-0.000010	0.000002	0.000086	-0.000099	-0.000059	0.000002	0.000278
Tl	190.794	0.000124	-0.003174	-0.002041	-0.000012	-0.007422	0.000038	0.000352	-0.002062	-0.000201	0.000172	-0.000029	N/A

Approved By: SS 4-4-96 Approved By: BJO 4-4-96

QA/QC Supervisor Area Supervisor

5.2 **Physical interferences** are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations due to a decrease in nebulization and transport efficiencies. Samples containing large amounts of elements may also decrease the forward power available to the plasma for elemental excitation. The Optima 3000 compensates for the viscosity and solids content by using on-line internal standard addition. The internal standard, in this case Sc, is added via a peristaltic pump to the sample stream as it is pumped into the plasma. If the internal standard intensity decreases in a sample relative to a standard, the data for that sample is electronically altered to reflect the assumed decrease in analyte intensity. Conversely, if the internal standard intensity increases for a sample, the resulting intensities for the analytes will be lowered. The Rf generator used by Perkin Elmer in the Optima 3000 is a free running generator, meaning that the generator may compensate for a decrease in the forward power by increasing the amount of power to the Rf coil. The result of this compensation is that the forward power available to the plasma will remain at the set level when large quantities of analytes are introduced into the system. The Optima 3000 also uses a mass flow control for the Ar supply which has been reported to improve instrument performance.

5.3 **Chemical interferences** include molecular compound formation, ionization effects, and solute vaporization effects. Normally, these effects are not significant with the ICP technique. If observed, they can be minimized by careful selection of operating conditions (incident power, observation position, and so forth), by buffering of the sample, by matrix matching, and by standard addition procedures. Chemical interferences are highly dependent on matrix type and the specific analyte element.

6.0 SAFETY PRECAUTIONS

6.1 The analyst must comply with all standard operating procedures for health and safety as outlined in the "WWES Laboratory Safety Manual".

6.2 Concentrated acids are used in the preparation of standards and samples for analysis by ICP. Gloves and safety glasses must be worn at all times when handling concentrated acids. Gloves must also be worn when handling digested samples. Please refer to the MSDSs for information on these or any other chemicals utilized in this procedure.

6.3 Check the exhaust hood over the instrument to be sure it is operating correctly. If the ventilation system is not working properly, extinguish the plasma if lit and immediately contact the metals lab supervisor. Under no circumstances should the ICP be used if the exhaust hood is not working.

6.4 UV protective glasses must be worn at all times in the metals laboratory. The plasma emits UV radiation. Avoid looking directly at the plasma without some type of strong UV protection. The instrument uses a very UV resistant material in the viewing port so the analyst may watch the plasma. Do not tamper with this plate. Do not operate the machine without this plate in place. Do not attempt to view the plasma directly or indirectly in any way. Failure to follow this policy may cause very serious and immediate damage to the retina of the eye.

6.5 The ICP emits a strong Rf field. To minimize exposure to this field, Perkin Elmer has included several safety interlocks to prevent direct exposure of the analyst to harmful radiation. Never override any interlock on the ICP. When working on the instrument, always replace all of the Rf shielding using all of the supplied screws. If any safety device has been tampered with, contact the metals lab supervisor.

6.6 The ICP uses Ar to sustain the plasma and to nebulize sample into the plasma. Although Ar in and of itself is not hazardous or flammable, it may cause suffocation through oxygen deprivation. It is therefore imperative that all sources of Ar be turned off with a valve when not in use. Since Ar is colorless and odorless, if you feel lightheaded, please evacuate the metals lab at once and notify the metals lab supervisor. Please refer to the MSDSs for information on this or any other chemicals utilized in this procedure.

6.7 Many of the elements used in this procedure are toxic if ingested. Please refer to the MSDSs for information on these or any other chemicals utilized in this procedure.

6.8 No food or drink is allowed in the metals lab. Food or drink may become contaminated with acid or metals and may therefore be hazardous.

6.9 Wash hands before starting work. Chemicals may be present on the skin which may interfere with metals analysis. Wash hands before leaving the metals lab. Chemicals and acids may be on the skin which could eventually be ingested or passed on to a third party through casual contact.

7.0 SAMPLE SIZE, COLLECTION, PRESERVATION, AND HANDLING PROCEDURES

7.1 Aqueous samples must be acidified at the time of collection to pH < 2.

7.2 Solid samples require no preservation for metals.

7.3 All samples may be collected in glass or plastic. If Silicon or Boron is to be analyzed, plastic containers must be used. The acidified sample must never come into contact with any metal as this would cause leaching of the metal into the sample.

7.4 For the analysis of dissolved metals, the sample should be filtered on site and then acidified to pH <2.

7.5 Holding times for all metals for ICP analysis is 180 days. In the case of TCLP or similar extracts, the hold time starts at the time of filtration.

7.6 The minimum sample size for this method is 3 ml of aqueous sample per metal to be analyzed. This implies that the sample must be solubilized prior to analysis. A smaller minimum amount may be used if the sample may be diluted at the sacrifice of the detection limit.

7.7 Digested (solubilized) samples and undigested acidified aqueous samples need not be refrigerated. Solid samples should be refrigerated so that other parameters may be performed on them. All samples must be at room temperature before analysis.

8.0 APPARATUS, MATERIALS, AND REAGENTS

8.1 Inductively coupled argon plasma emission spectrometer:

8.1.1 Optima 3000 Inductively Coupled Plasma Optical Emission Spectrometer with an Eschelle based polychromater and a Segmented-array Charge-coupled-device Detector (SCD). The instrument is capable of taking readings in the UV/VIS spectrum with a wavelength range of 167 to 782 nm. The Rf generator employed runs at 40 MHz.

Operating conditions: The analyst should follow the instructions provided by the instrument's manufacturer. For operation with organic solvents, use of the auxiliary argon inlet is recommended, as are solvent-resistant tubing, increased plasma (coolant) argon flow, decreased nebulizer flow, and increased Rf power to obtain stable operation and precise measurements. Sensitivity, instrumental detection limit, precision, linear dynamic range, and interference effects must be established for each individual analyte line on that particular instrument. All measurements must be within instrument linear range. The analyst must (1) verify that the instrument configuration and operating conditions satisfy the analytical requirements and (2) maintain quality control data confirming instrument performance and analytical results.

8.1.2 Perkin Elmer IEEE autosampler, model AS-90. This autosampler should be installed by a Perkin Elmer representative.

8.2 Recirculator/chiller, Polyscience 633 or equivalent. Temperature should be maintained at 18°C and pressure should be at 50 psi. The recirculator is attached directly to the Optima 3000 to maintain isothermal conditions within the optics cavity.

8.3 Computer running Perkin Elmer control software. An IBM compatible 80486SX25 or better computer with at least 8 MB RAM, a 500 MB hard disk, and a VGA color monitor is needed. The current software used by the instrument is Optima 3000 software version 1.2 running in a UNIX environment. The software version may be updated without notice if it performs at least as well as the older version. Major updates, such as moving to another operating platform will require an update to this SOP.

8.4 Epson printer or equivalent. The specific printer used must respond to Epson printing codes. The printer must be attached to the computer using an appropriate communication cable. Please refer to the Instrument manual for further printer specifications.

8.5 15 ml clear centrifuge tubes or equivalent. Tubes should stand upright within the autosampler rack without tipping or leaning.

8.6 Eppendorf pipettors capable of delivering 50-1000 µl.

8.7 Class A volumetric flasks, various volumes.

8.8 Class A reusable pipettes, various volumes.

9.0 ROUTINE PREVENTIVE MAINTENANCE

9.1 At the beginning of each shift (every 8 hours) the manifold pump tubing must be replaced. Please see section 14.7 for a discussion on changing the pump tubing. Update the instrument maintenance logbook.

9.2 There are 3 filters on the Optima 3000 that must be cleaned every week. The first two filters is located on the back of the instrument on the right-hand side. The third filter is located on the left side under the instrument.

9.2.1 Remove the filters from the holders. The left-hand filters have a cover that 'pops' off. The right-hand filter just slide up and out of its holder.

9.2.2 Wash the filters in soap and water to loosen any dirt and dust from the filters.

9.2.3 Squeeze any excess water from the filters. Dry the filters with a paper towel. Allow these filters to air dry.

9.2.4 If there are extra filters, replace the filters on the instrument, otherwise wait until the newly washed filters are dry before replacing them.

9.2.5 Place a note in the instrument maintenance logbook that the filters were cleaned.

9.3 Inspect the Ar supply when the shift begins. If the liquid level of the Ar falls below the reorder mark, notify the person responsible for ordering gasses or the metals supervisor.

9.4 Inspect the waste container on the floor under the instrument every shift. If the jug is full, properly dispose of the liquid.

9.5 Visually inspect the torch before lighting the instrument. Do not touch or move the torch. This inspection should be visible only.

9.5.1 Open the doors to the torch chamber.

9.5.2 Observe the torch. If the torch is broken or cracked, replace it. See section 9.6 for a discussion on how to disassemble the torch and assembly.

9.5.3 Listen for any obvious leaks in the Ar lines going to the torch or nebulizer. If leaks are heard, investigate them and tighten the fittings to stop the leak. If the leak cannot be found or cannot be stopped, contact the metals lab supervisor.

9.6 Once every for to eight weeks disassemble the entire torch assembly and inspect all parts for wear. Replace all worn or damaged parts. Record all changes in the instrument maintenance logbook.

9.6.1 Turn off the plasma if it is on by selecting the 'Plasma Off' button on the keyboard <F4>.

9.6.2 Turn off the pump if it is still on by pressing <F2>.

9.6.3 Open the front door to the torch chamber and then the side door to the torch chamber.

9.6.4 Remove the plastic tray under the torch assembly.

9.6.5 Remove the quick-change assembly by loosening the knurled screw while supporting the assembly with the other hand.

9.6.6 Remove the sample line from the bottom of the nebulizer and remove the drain line from the end of the spray chamber. These lines can be simply pulled out from their respective places.

9.6.7 Place the quick-change assembly in the assembly holder. Use the knurled screw to attach the assembly to the mounting bracket. Ensure that the assembly is secured to the bracket before going to the next step.

9.6.8 Remove the three knurled screws next to the torch.

9.6.9 Gently twist the torch collar to break any seal the may have formed.

9.6.10 Remove the torch. Very gently twist the torch while pulling toward yourself. There are two O-rings that must be cleared before the torch will come free. Expect a sudden lack of resistance as the torch clears the second O-ring. Remove the Ar line going to the torch using only fingers if possible. If a wrench is needed be extremely careful not to torque the quartz arms on the torch. Set on the counter for further inspection.

9.6.11 Remove the alumina injector. Gently twist and pull the alumina injector from its holder. Set on the counter for further inspection.

9.6.12 Remove the screws under the spray chamber to release the collar that holds the spray chamber in place. Pull the spray chamber down to remove it from the assembly. The alumina injector holder should still be attached to the spray chamber at this point.

9.6.13 Remove the alumina injector holder. Unscrew the holder counterclockwise until it passes clear of the O-ring holding it in place. Set on the counter for further inspection.

9.6.14 Inspect the drain line at the base of the spray chamber. There should be no leaks or cracks in the tubing. If a problem exists, replace the O-rings in the drain cap. Place a note in the instrument maintenance logbook that the tubing was replaced.

9.6.15 Inspect the nebulizer for wear.

9.6.15.1 Salt deposits, if present, should be removed with water.

9.6.15.2 If a cross-flow nebulizer is used, check the tips for wear. Replace the tips if excessive wear is noted. Record any actions in the instrument maintenance logbook.

9.6.16 Replace the alumina injector with a newly cleaned one. To clean dirty alumina injectors, place them in a plastic 100 ml graduated cylinder. In a hood, cover the injectors with aqua regia. Allow the injectors to soak for 2 hours. Rinse the alumina injectors with tap water, then ASTM Type II water. Place clean injectors in the appropriate drawer for future use. Record the change in the instrument maintenance logbook.

9.6.17 Check all O-rings on the alumina injector holder. Any cracked or chipped O-rings must be replaced with new ones. The book located next to the spare parts drawers has an exploded view of the torch assembly. Use this diagram to identify the exact part number needed for replacement. Note any replacements in the instrument maintenance logbook.

9.6.18 Check the torch for damage. Brown discoloration at the top of the torch is normal. Since the Optima 3000 torch has exit windows cut into the torch for light to pass through, this discoloration need not be rectified. Look at the bottom of the torch. There are frequently chips in the torch at this spot on the torch. If chips are observed, replace the torch. Never use a torch that is chipped, cracked, or broken. See the metals lab supervisor for help in replacing the torch as this procedure is beyond the scope of this SOP. Note replacement in the instrument maintenance logbook.

9.6.19 Replace the alumina injector support in the spray chamber. Screw the holder in to the spray chamber. If the support is still installed correctly, contact the metals lab supervisor for assistance.

9.6.20 Re-install the spray chamber and alumina injector holder unit in the quick-change mount from the bottom. Replace the collar around the spray chamber and replace the knurled screws that hold the chamber in place.

9.6.21 Replace the alumina injector. Place the alumina injector in the support while pushing and twisting the injector. Press in firmly until it stops.

9.6.22 Replace the torch on the assembly. Place the torch collar on the torch. Push the collar all the way up to the torch arms. Gently reinstall the torch over the alumina injector holder by twisting and pushing. Do not torque the arms of the torch. Do align the torch so that it will go on straight without binding the torch. Push until the torch comes to a stop on the alumina injector holder. The analyst may wish to wear gloves and hold the torch with a paper towel while performing this procedure since it is possible to shatter the torch while installing it. If the torch shatters, restart this procedure at step 9.6.9 and contact the metals lab supervisor for assistance when you reach step 9.6.22.

9.6.23 Replace the nebulizer. Gently twist the nebulizer on to the spray chamber until it stops. Tighten the two knurled screws finger tight only. Re-attach the Ar line going to the nebulizer. Reattach the sample line going to the nebulizer.

9.6.24 Replace the torch assembly on the mounting bracket. Slide quick-change unit into place, taking care not to bind the torch on the Rf coil bonnet. It should click into place as you push up on it. While holding onto the torch assembly with one hand, tighten the knurled screw with the other. Do not overtighten this screw. If the assembly appears to be safely secured, all is okay. If the assembly does not stay secured, back the screw out a little and try again. If this procedure still does not work, contact the metals lab supervisor.

9.6.25 Close the torch box doors.

9.6.26 Note any changes made to the torch during this procedure in the instrument maintenance logbook.

9.7 Inspect the printing quality of the printer. If the print is hard to read or light in appearance, replace the printer cartridge with the appropriate replacement.

10.0 CHEMICALS AND REAGENTS

10.1 Acids used in the preparation of standards and for sample processing must be reagent grade or better. Redistilled acids may be used if it has been demonstrated that the acid is free from contamination.

10.1.1 Concentrated hydrochloric acid, trace metal grade (Fisher Cat #A50B-212).

10.1.2 Hydrochloric acid, trace metal grade (1:1): Add 500 mls concentrated HCl to 400 mls ASTM Type II water. Cool. Dilute to 1L.

10.1.3 Concentrated nitric acid, trace metal grade (Fisher Cat. #A509-212).

10.2 **ASTM Type II water** (ASTM D1193). Deionized water is fed into an all glass distillation unit from Barnstead (Model FI-STREEM 2). The resulting distillate is immediately placed into a plastic container. Impurities are measured by the Inorganic group at TriMatrix. This is the only water acceptable for use in the Metals lab for dilutions or standard preparation.

10.3 **Standard stock solutions** are purchased primarily from Inorganic Ventures. All stock solutions are ICP grade single-element solutions at concentrations of 1000 or 10000 ppm.

10.4 Argon gas supply: Welding grade or better. Currently, this is plumbed from a liquid Ar tank located outside of the building. Ar is used as the main plasma gas, the auxiliary plasma gas, the nebulizer carrier gas, and the Rf coil coolant.

10.5 Nitrogen gas supply: Currently, this is plumbed from a liquid N_2 tank located outside of the building. N_2 is used to purge the optics cavity of Oxygen so that measurements below 190nm may be made accurately.

11.0 STANDARDS

Three sets of standards should be prepared with ASTM Type II water and the following acid concentrations:

- 15% HNO_3/10% HCl (for analysis of soils, sludges, etc.).
- 6% HNO_3/5% HCl (for analysis of wastewaters and digested waters, TCLPs, etc.).
- 0.5% HNO_3 (for analysis of undigested waters).

11.1 All primary standards expire one year after receipt or on the date located on the standard bottle, whichever is earlier.

11.2 All working standards for the ICP that are prepared from primary standards expire 3 months after preparation. All dilutions of working standards expire 3 months after preparation.

11.3 Prepare the 100X concentrated standard OPT A:

11.3.1 Rinse a clean 1000 ml class A volumetric flask with ASTM Type II water a minimum of three times.

11.3.2 Place about 100 ml ASTM Type II water into the flask.

11.3.3 Pipette 20 ml HNO_3 into the flask and swirl.

11.3.4 Pipette the following amounts of the standards below into the flask, swirling after each addition. Always use a new pipette for each standard and never pipette directly out of the primary standard source bottle.

100 ml each of 10,000 ppm Ca, Mg, Na, K
50 ml each of 10,000 ppm As, Se, P, Al
10 ml each of 10,000 ppm Tl, V, Ba, Be, B, Cu, Fe, Li, Zn, Cd, Cr, Co, Pb, Mn, Ni, Sr

11.3.5 Dilute the flask to volume with ASTM Type II water and mix well.

11.3.6 Pour the contents of the flask into a clean bottle and label the bottle to describe its contents.

11.3.7 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

Table 3
100X Concentration OPT A

Element	Concentration (ppm)
Ca	1000
Mg	1000
Na	1000
K	1000
As	500
Se	500
P	500
Al	500
Tl	100
V	100
Ba	100
Be	100
B	100
Cu	100
Fe	100
Li	100
Zn	100
Cd	100
Cr	100
Co	100
Pb	100
Mn	100
Ni	100
Sr	100

11.4 Prepare the 100X concentrated standard OPT B

11.4.1 Rinse a clean 1000 ml class A volumetric flask with ASTM Type II water a minimum of three times.

11.4.2 Place about 100 ml ASTM Type II water into the flask.

11.4.3 Pipette 20 ml HNO_3 into the flask and swirl.

11.4.4 Pipette the following amounts of the standards below into the flask, swirling after each addition. Always use a new pipette for each standard and never pipette directly out of the primary standard source bottle.

50 ml each of 10,000 ppm Sb, Sn, Si
10 ml each of 10,000 ppm Mo, Ti

11.4.5 Dilute the flask to volume with ASTM Type II water and mix well.

11.4.6 Pour the contents of the flask into a clean bottle and label the bottle to describe its contents.

11.4.7 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

Table 4
100X Concentration OPT B

Element	Concentration (ppm)
Sb	500
Sn	500
Si	500
Mo	100
Ti	100

11.5 Prepare the working standards for OPT A

11.5.1 Rinse two clean 500 ml class A volumetric flasks with ASTM Type II water a minimum of three times.

11.5.2 Place about 100 ml ASTM Type II water into each flask.

11.5.3 Pipette the correct amounts of acid into the flasks depending on the final acid concentration desired.

11.5.3.1 For 10% HCL/15% HNO_3, place 50 ml HCL into the flask and swirl. When the mixing lines are gone from solution, add 75 ml HNO_3 to the flask and swirl until the mixing lines are gone.

11.5.3.2 For 5% HCL/6% HNO_3, place 25 ml HCL into each flask and swirl. When the mixing lines are gone from solution, add 30 ml HNO_3 to each flask and swirl until the mixing lines are gone.

11.5.3.3 For 0.5% HNO_3, place 2.5 ml HNO_3 into each flask and swirl until the mixing lines are gone.

11.5.4 Pipette 5 ml of the 100X concentration OPT A solution into one of the flasks. This is the calibration standard (Std OPT A).

11.5.5 Pipette 2.5 ml of the 100X concentration OPT A solution into the other flask. This is the continuing calibration verification standard (CCV OPT A).

11.5.6 Dilute the flasks to volume with ASTM Type II water and mix well. Cool to room temperature. Dilute to the mark again.

11.5.7 Pour the contents of the flasks into clean bottles and label the bottles to describe their contents.

11.5.8 Update the standard log book. Transfer the stock standard numbers and preparation date from the book to the standard bottles.

Table 5
OPT A Working Solutions

Element	Concentration (ppm) Std OPT A	Concentration (ppm) CCV OPT A
Ca	10	5
Mg	10	5
Na	10	5
K	10	5
As	5	2.5
Se	5	2.5
P	5	2.5
Al	5	2.5
Tl	1	0.5
V	1	0.5
Ba	1	0.5
Be	1	0.5
B	1	0.5
Cu	1	0.5
Fe	1	0.5
Li	1	0.5
Zn	1	0.5
Cd	1	0.5
Cr	1	0.5
Co	1	0.5
Pb	1	0.5
Mn	1	0.5
Ni	1	0.5
Sr	1	0.5

11.6 Prepare the working standards for OPT B

11.6.1 Rinse two clean 500 ml class A volumetric flasks with ASTM Type II water a minimum of three times.

11.6.2 Place about 100 ml ASTM Type II water into each flask.

11.6.3 Pipette the correct amounts of acid into the flasks depending on the final acid concentration desired.

11.6.3.1 For 10% HCL/15% HNO_3, place 50 ml HCL into the flask and swirl. When the mixing lines are gone from solution, add 75 ml HNO_3 to the flask and swirl until the mixing lines are gone.

11.6.3.2 For 5% HCL/6% HNO_3, place 25 ml HCL into each flask and swirl. When the mixing lines are gone from solution, add 30 ml HNO_3 to each flask and swirl until the mixing lines are gone.

11.6.3.3 For 0.5% HNO_3, place 2.5 ml HNO_3 into each flask and swirl until the mixing lines are gone.

11.6.4 Pipette 5 ml of the 100X concentration OPT B solution into one of the flasks. This is the calibration standard (Std OPT B).

11.6.5 Pipette 2.5 ml of the 100X concentration OPT B solution into the other flask. This is the continuing calibration verification standard (CCV OPT B).

11.6.6 Dilute the flasks to volume with ASTM Type II water and mix well. Cool to room temperature. Dilute to the mark again.

11.6.7 Pour the contents of the flasks into clean bottles and label the bottles to describe their contents.

11.6.8 Update the standard log book. Transfer the stock standard numbers and preparation date from the book to the standard bottles.

Table 6
OPT B Working Solutions

Element	Concentration (ppm) Std OPT B	Concentration (ppm) CCV OPT B
Sb	5	2.5
Sn	5	2.5
Si	5	2.5
Mo	1	0.5
Ti	1	0.5

11.7 Prepare the working standards for OPT C

11.7.1 Rinse two clean 500 ml class A volumetric flasks with ASTM Type II water a minimum of three times.

11.7.2 Place about 100 ml ASTM Type II water into each flask.

11.7.3 Pipette the correct amounts of acid into the flasks depending on the final acid concentration desired.

11.7.3.1 For 10% HCL/15% HNO_3, place 50 ml HCL into the flask and swirl. When the mixing lines are gone from solution, add 75 ml HNO_3 to the flask and swirl until the mixing lines are gone.

11.7.3.2 For 5% HCL/6% HNO_3, place 25 ml HCL into each flask and swirl. When the mixing lines are gone from solution, add 30 ml HNO_3 to each flask and swirl until the mixing lines are gone.

11.7.3.3 For 0.5% HNO_3, place 2.5 ml HNO_3 into each flask and swirl until the mixing lines are gone.

11.7.4 Pipette 0.5 ml of the 1000 ppm stock standard solution into one of the flasks. This is the calibration standard (Std OPT C).

11.7.5 Pipette 0.25 ml of the 1000 ppm stock standard solution into the other flask. This is the continuing calibration verification standard (CCV OPT C).

11.7.6 Dilute the flasks to volume with ASTM Type II water and mix well. Cool to room temperature. Dilute to the mark again.

11.7.7 Pour the contents of the flasks into clean bottles and label the bottles to describe their contents.

11.7.8 Update the standard log book. Transfer the stock standard numbers and preparation date from the book to the standard bottles.

Table 7
OPT C Working Solutions

Element	Concentration (ppm) Std OPT C	Concentration (ppm) CCV OPT C
Ag	1	0.5

11.8 Prepare the interelement check standard solution number 1 (IEC-1)

11.8.1 The solution Interf-1 is purchased from Inorganic Ventures.

11.8.2 Prepare solution Analyte-1.

11.8.2.1 Rinse a clean 100 ml class A volumetric flask with ASTM Type II water a minimum of three times.

11.8.2.2 Place 2 ml HNO_3 in the flask.

11.8.2.3 Pipette the following amounts of the standards below into the flask, swirling after each addition. Always use a new pipette for each standard and never pipette directly out of the primary standard source bottle.

10 ml each of 1000 ppm Ag, Cd, Ni, Pb, Zn
5 ml each of 1000 ppm Ba, Be, Co, Cr, Cu, Mn, V

11.8.2.4 Dilute the flask to volume with ASTM Type II water and mix well.

11.8.2.5 Pour the contents of the flask into a clean bottle and label the bottle to describe its contents.

11.8.2.6 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

11.8.3 Prepare the solution IEC-1.

11.8.3.1 Rinse a clean 500 ml class A volumetric flask with ASTM Type II water a minimum of three times.

11.8.3.2 Place about 100 ml ASTM Type II water into the flask.

11.8.3.3 Pipette the correct amounts of acid into the flask depending on the final acid concentration desired.

11.8.3.3.1 For 10% HCL/15% HNO_3, place 50 ml HCL into the flask and swirl. When the mixing lines are gone from solution, add 75 ml HNO_3 to the flask and swirl until the mixing lines are gone.

11.8.3.3.2 For 5% HCL/6% HNO_3, place 25 ml HCL into each flask and swirl. When the mixing lines are gone from solution, add 30 ml HNO_3 to each flask and swirl until the mixing lines are gone.

11.8.3.3.3 For 0.5% HNO_3, place 2.5 ml HNO_3 into each flask and swirl until the mixing lines are gone.

11.8.3.4 Pipette 50 ml of the solution Interf-1 into the flask. Swirl the flask.

11.8.3.5 Pipette 5 ml of the solution Analyte-1 into the flask. Swirl the flask.

11.8.3.6 Dilute the flask to volume with ASTM Type II water and mix well. Cool to room temperature. Dilute to the mark again.

11.8.3.7 Pour the contents of the flasks into clean bottles and label the bottles to describe their contents.

11.8.3.8 Update the standard log book. Transfer the stock standard numbers and preparation date from the book to the standard bottles.

Table 8
IEC-1 Working Solution

Element	Concentration (ppm)
Al	500
Ba	0.5
Be	0.5
Ca	500
Cd	1.0
Co	0.5
Cr	0.5
Cu	0.5
Fe	200
Mg	500
Mn	0.5
Ni	1.0
Pb	1.0
V	0.5
Zn	1.0

11.9 Prepare the interelement check standard solution number 2 (IEC-2).

11.9.1 Prepare solution Interf-2.

11.9.1.1 Rinse a clean 500 ml class A volumetric flask with ASTM Type II water a minimum of three times. Place 10 ml HNO_3 in the flask.

11.9.1.2 Pipette the following amounts of the standards below into the flask, swirling after each addition. Always use a new pipette for each standard and never pipette directly out of the primary standard source bottle.

50 ml each of 10,000 ppm Cr, Cu, Mn, Ni, Ti, V

11.9.1.3 Dilute the flask to volume with ASTM Type II water and mix well.

11.9.1.4 Pour the contents of the flask into a clean bottle and label the bottle to describe its contents.

11.9.1.5 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

11.9.2 Prepare solution Analyte-2

11.9.2.1 Rinse a clean 100 ml class A volumetric flask with ASTM Type II water a minimum of three times. Place 10 ml HNO_3 in the flask.

11.9.2.2 Pipette the following amounts of the standards below into the flask, swirling after each addition. Always use a new pipette for each standard and never pipette directly out of the primary standard source bottle.

10 ml each of 1000 ppm Al, As, B, Mo, Sb, Se, Tl
5 ml each of 10,000 ppm Ca, Mg, Na
1 ml of 10,000 ppm Fe
1 ml of 1000 ppm Si

11.9.2.3 Dilute the flask to volume with ASTM Type II water and mix well.

11.9.2.4 Pour the contents of the flask into a clean bottle and label the bottle to describe its contents.

11.9.2.5 Update the standard log book. Transfer the stock standard number and preparation date from the book to the standard bottle.

11.9.3 Prepare the solution IEC-2

11.9.3.1 Rinse a clean 500 ml class A volumetric flask with ASTM Type II water a minimum of three times.

11.9.3.2 Place about 100 ml ASTM Type II water into the flask.

11.9.3.3 Pipette the correct amounts of acid into the flask depending on the final acid concentration desired.

11.9.3.3.1 For 10% HCL/15% HNO_3, place 50 ml HCL into the flask and swirl. When the mixing lines are gone from solution, add 75 ml HNO_3 to the flask and swirl until the mixing lines are gone.

11.9.3.3.2 For 5% HCL/6% HNO_3, place 25 ml HCL into each flask and swirl. When the mixing lines are gone from solution, add 30 ml HNO_3 to each flask and swirl until the mixing lines are gone.

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11.9.3.3.3 For 0.5% HNO_3, place 2.5 ml HNO_3 into each flask and swirl until the mixing lines are gone.

11.9.3.4 Pipette 50 ml of the solution Interf-2 into the flask. Swirl the flask.

11.9.3.5 Pipette 5 ml of the solution Analyte-2 into the flask. Swirl the flask.

11.9.3.6 Dilute the flask to volume with ASTM Type II water and mix well. Cool to room temperature. Dilute to the mark again.

11.9.3.7 Pour the contents of the flasks into clean bottles and label the bottles to describe their contents.

11.9.3.8 Update the standard log book. Transfer the stock standard numbers and preparation date from the book to the standard bottles.

Table 9
IEC-2 Working Solution

Element	Concentration (ppm)
Al	1.0
As	1.0
B	1.0
Ca	5.0
Cr	100
Cu	100
Mg	5.0
Mn	100
Mo	1.0
Na	5.0
Ni	100
Sb	1.0
Se	1.0
Si	0.1
Ti	100
Tl	1
V	100

12.0 SAMPLE PREPARATION

12.1 Soil, sludge, and waste samples must be digested according to method 3050 prior to analysis. Please see the specific SOP for the detailed preparation procedure.

12.2 Samples that have extraction performed on them, such as TCLP, SPLP, EPTox, and ASTM, must first be extracted then be digested using method 3010. Please see the specific SOP for the detailed preparation procedure.

12.3 Wastewater samples must be prepared using method 3010. Please see the specific SOP for the detailed preparation procedure.

12.4 Oil samples may be digested using method 3051. Please see the specific SOP for the detailed preparation procedure.

12.5 Air samples are prepared using the digestion method specified in the method that was used in the collection of the samples.

12.6 Pure product samples are prepared according to the manufacturer, or according to a method developed by TriMatrix if available. Please see the specific SOP or dissolution procedure provided by the manufacturer for the detailed preparation procedure.

13.0 CALIBRATION PROCEDURES

13.1 The Optima 3000 must be calibrated for every analytical run or every 24 hours, whichever is more frequent.

13.1.1 Calibration standards are prepared according to Section 11. The final concentrations of the working standards used to create the curve are located in Tables .

13.1.2 In most cases, calibration is performed using a single standard and a calibration blank. The correlation coefficient for this type of curve is necessarily 1. If a multi-point calibration is performed, the correlation coefficient must be greater than or equal to 0.995. If the coefficient is less than 0.995, recalibrate the instrument. If the coefficient is still less than 0.995, contact the metals lab supervisor for assistance.

13.2 After calibration, an initial demonstration of the calibration is performed.

13.2.1 Analyze the ICS/ICV. The ICS/ICV is the highest standard solution read back from the standard curve as a sample. The acceptance window for this QC is 95% to 105% recovery of the true value. If the ICS/ICV is not within the control limits, recalibrate the instrument and start again at step 13.2. If the ICS/ICV is still out of the control limits, see the metals lab supervisor.

13.2.2 Analyze the CCV. The CCV is a standard solution with a concentration of one half the standard solution used for the calibration. The acceptance window for this QC is 90% to 110% recovery of the true value. If the CCV is not within the control limits, recalibrate the instrument and start again at step 13.2. If the CCV is still out of the control limits, see the metals lab supervisor.

13.2.3 Analyze the ICB/CCB. The ICB/CCB is the calibration blank and has the same acid concentration as the standards. The absolute value of the ICB/CCB reading must be less than the lowest reporting limit required for the analysis. If the ICB/CCB is not within the control limits, recalibrate the instrument and start again at step 13.2. If the ICB/CCB is still out of the control limits, see the metals lab supervisor.

13.2.4 Analyze the IEC (Interelement Correction Standard). The IEC is a standard that contains four or six elements at high concentrations with many other elements at trace level. Its purpose is to demonstrate that with the current interelement correction factors in place, there are no spectral interferences. The acceptance window for this QC is 80% to 120% recovery of the true value for the elements at their trace level. If the IEC is not within the control limits, then a spectral interference has been encountered.

13.2.4.1 If the interference is a known interference and is being corrected for, calculate the corrected concentration based on the formula presented in Section 5.1.1 and use the corrected concentration in the percent recovery calculation. If the percent recovery is not within the control limits using the corrected concentration, recalibrate the instrument and start again at step 13.2. If the percent recovery is still not within control limits, contact the metals lab supervisor.

13.2.4.2 If the interference is a known interference and is not being corrected for, recalibrate the instrument ensuring that the interfering element is being analyzed for in the samples and start again at step 13.2.

13.2.4.3 If the interference is not known, contact the metals lab supervisor for assistance.

13.2.5 Analyze an independent check solution, called an LCS. The control windows for the LCS are dictated by the LIMS system. If no LIMS control limits have been established for an analyte, default windows of 80% to 120% recovery of the true values should be used until control limits have been established. If the percent recovery does not fall within the control windows, recalibrate the instrument and start the analysis at step 13.2.

13.2.6 Analyze up to ten samples. A sample is defined as the average of two replicate readings of a solution that is not an ICS/ICV or a CCV. The following solutions would qualify as samples: IECs, LCSs, MPBs, LFBs, spiked samples, and matrix spike duplicates. The only solutions that are not considered samples are the ICS/ICV, ICB/CCB, CCV, and CCB solutions.

13.2.7 Analyze the CCV. The CCV is a standard solution with a concentration of one half the standard solution used for the calibration. The acceptance window for this QC is 90% to 110% recovery of the true value. If the CCV is not within the control limits, recalibrate the instrument and start again at step 13.2. All samples since the last good ICS/ICV or CCV must be reanalyzed.

13.2.8 Analyze the CCB. The CCB is the calibration blank and has the same acid concentration as the standards. The absolute value of the CCB reading must be less than the lowest reporting limit required for the analysis. If the CCB is not within the control limits, recalibrate the instrument and start again at step 13.2. All samples since the last good ICB/CCB or CCB must be reanalyzed.

13.2.9 Repeat steps 13.2.6 through 13.2.8 until the end of the run.

13.2.10 Every eight hours of instrument operation an IEC must be analyzed. The IEC is a standard that contains four or six elements at high concentrations with many other elements at trace level. Its purpose is to demonstrate that the with the current interelement correction factors in place, there are no spectral interferences. The acceptance window for this QC is 80% to 120% recovery of the true value for the elements at their trace level. If the IEC is not within the control limits, then a spectral interference has been encountered.

13.2.10.1 If the interference is a known interference and is being corrected for, calculate the corrected concentration based on the formula presented in Section 5.1.1 and use the corrected concentration in the percent recovery calculation. If the percent recovery is not within the control limits using the corrected concentration, recalibrate the instrument and start again at step 13.2. All samples since the last good IEC must be repeated. If the percent recovery is still not within control limits, contact the metals lab supervisor.

13.2.10.2 If the interference is a known interference and is not being corrected for, recalibrate the instrument ensuring that the interfering element is being analyzed for in the samples and start again at step 13.2. All samples since the last good IEC must be repeated.

13.2.10.3 If the interference is not known, contact the metals lab supervisor for assistance.

13.2.11 Analyze the CCV. The CCV is a standard solution with a concentration of one half the standard solution used for the calibration. The acceptance window for this QC is 90% to 110% recovery of the true value. If the CCV is not within the control limits, recalibrate the instrument and start again at step 13.2. All samples since the last good ICS/ICV or CCV must be reanalyzed.

13.2.12 Analyze the CCB. The CCB is the calibration blank and has the same acid concentration as the standards.. The absolute value of the CCB reading must be less than the lowest reporting limit required for the analysis. If the CCB is not within the control limits, recalibrate the instrument and start again at step 13.2. All samples since the last good ICB/CCB or CCB must be reanalyzed.

14.0 ANALYTICAL PROCEDURE

NOTE: The following section assumes that the user is familiar with the Optima 3000 operating software. If you are unfamiliar or unsure, please consult the instrument manual for additional instruction. This procedure will provide adequate instruction for novices, but is not intended to replace the instrument operating manual.

14.1 Preliminary treatment of all matrices is always necessary because of the complexity and variability of sample matrices. Digestion procedures are presented in Sample

Preparation Methods (Methods 3005-3050/200.0/200.7). An internal standard is always used.

14.2 Turn on the instrument.

14.2.1 Turn on the main power if it is not already on.

14.2.2 Turn on the Rf generator power if it not already on.

14.2.3 Turn on the autosampler power if it is not already on.

14.2.4 Turn on the recirculator power if it is not already on.

14.2.5 Turn on the Ar gas supply if it is not already on.

14.2.6 Turn on the N_2 gas supply if it is not already on.

14.2.7 Turn on the hood above the instrument if it is not already on.

14.3 Boot the computer and Optima 3000 software.

14.3.1 If the computer is already on and the Optima software is running, skip to step 14.4. If the computer is running and is in UNIX, go to section 14.3.7. If you are unsure of the status of the computer, please see the metals supervisor.

14.3.2 Turn on the computer, monitor, and printer. If any of the devices fail to turn on, please see the metals supervisor.

14.3.3 When the computer boots, it will display:

UNIX System V/386 on i80486

Boot:

14.3.4 Press <ENTER>.

The screen will display '**Loading kernel........**', some messages, and a table of file information. When the computer is ready for input, it will display:

Type CONTROL-D to proceed with normal startup
(or give root password for system maintenance):

NOTE: If the computer was not shut down properly, it will display a message stating that the root file system should be cleaned. If this occurs and you are unsure about what to do, please see the metals supervisor.

14.3.5 Press <Ctrl>d.

The screen will display:

Current System Time: XXX
Enter New Time:

14.3.6 Update the time, if necessary, or just press <ENTER>. The computer will then display copyrights and some messages. When the system is ready, it will display:

Welcome to SCO Open Desktop 2.0
scosysv!login:

14.3.7 Type **optima** at the scosysv!login prompt. More copyrights will be displayed, then the system will be loaded. A graphics screen will appear with four icons at the top, these indicate the current status of the system.

14.4 If the instrument power or Rf generator power was not on when the system was booted, an equilibration time will be required by the instrument before the plasma may be lit. The instrument software will alert the operator in this event. Wait until the instrument alerts you that it is ready before proceeding to the next step.

14.5 Recalibrate the spectrometer. The Hg recalibration helps to compensate for drift during the analysis. Although not required, this procedure will greatly increase the stability of the spectrometer and is therefore highly recommended. Enter the spectrometer mode by moving the cursor over to the Spectrometer entry, press <Enter>. Change the Hg calibration time to 3 minutes (0.051 hours) by typing in 0.051 then pressing F6. Turn on the Hg recalibration by pressing F5. Wait until the computer states that the Hg lamp recalibration is completed. Change the Hg recal time to 2 hours by typing 2 then pressing F6.

14.6 Enter the analyst that the analysis will be completed under.

14.6.1 From the main menu, press <Shift>F8.

14.6.2 Move the cursor to the correct analyst, press select, then press F5 (change analyst).

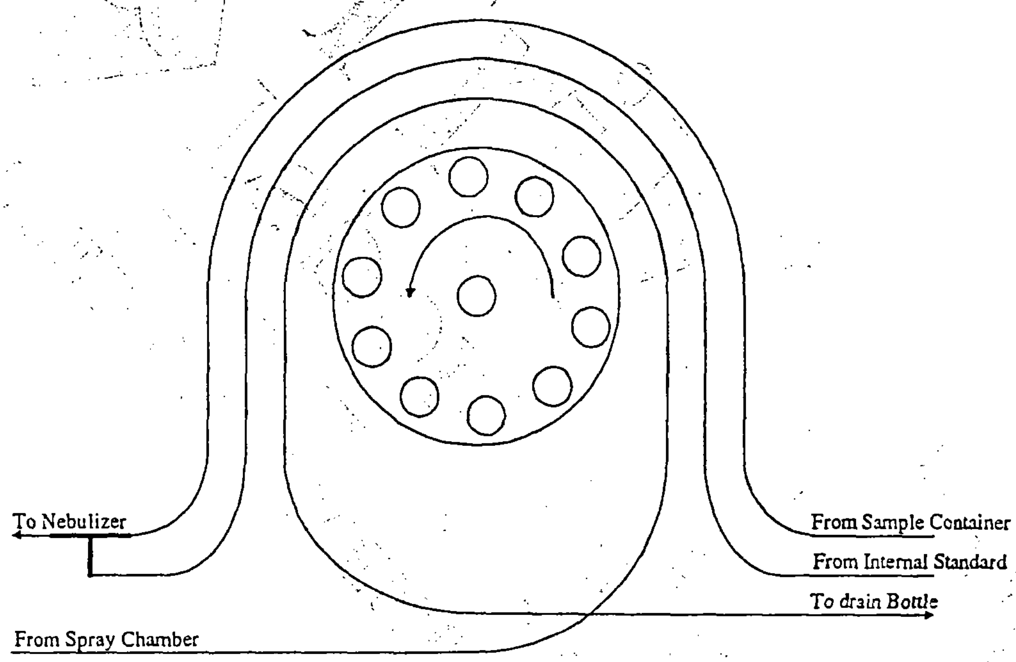
14.6.3 Exit to the main menu by pressing <Shift>F1.

14.7 Change the peristaltic pump tubing. Currently, three types of tubing are being used:

Black/Black	Sample line
Orange/Green	Internal standard line
Red/Red	Waste line

The tubing should be changed for every run since the tension exerted on the tubing by the pump will cause the tubing to stretch. Place the waste line on the bottom so that the pump is pumping the waste away from the ICP. Place the internal standard line in the middle so that the pump is pumping the internal standard toward the ICP. Place the sample line on the top so that the pump is pushing the sample to the ICP. Please see Figure 1 for the correct orientation of the pump tubing. Update the instrument maintenance log to reflect that you changed the pump tubing.

Figure 1
Peristaltic Pump Setup



14.8 Start the pump. Place the internal standard line and sample line into the rinse solution of ASTM Type II water located at position 0 on the autosampler. Press <Shift>F2 to start the pump. Check that liquid is flowing through all three pieces of tubing and that the flows of the solutions correspond to Figure 1. If solution is not flowing, slowly tighten the tension on the channel of the pump until solution begins to flow through it. Do not overtighten the pump tubing as this will greatly decrease the tubing life.

14.9 Light the plasma. For a discussion on the preparation for plasma ignition, please see the Optima 3000 Software Guide, page 2-13 through 2-18, section 5. Press F4 to light the plasma. Examine the plasma as described on page 2-15 of the manual. If an unstable plasma forms, immediately extinguish the plasma by pressing <Shift>F4 and attempt to relight the plasma by pressing F4. If an unstable plasma forms again, see the metals lab supervisor. When the a stable plasma has been established, allow the plasma to warm up for at least 30 minutes, preferably one hour, before running samples.

14.10 Table 10 lists the element file conditions in use at the time of this writing. Please note that any or all of the conditions listed below may change for an element without prior warning if it has been established that the new conditions are at least equivalent to those listed in the table.

Table 10
Element Conditions for the Optima 3000

Analyte	λ (nm)	Peak Window (nm)	Lower BGC (nm)	Upper BGC (nm)	Viewing Height (mm)	Internal Standard	Standard Concentration	Units	Subarray Number
Ag	328.065	0.0302	0.020	---	15	Sc	1000	ug/L	147
Al	396.140	0.0361	0.048	0.060	15	Sc	5030	ug/L	236
As	193.694	0.0177	0.012	0.012	15	Sc	5050	ug/L	8
B	249.773	0.0230	---	0.031	15	Sc	1005	ug/L	82
Ba	455.403	0.0843	---	0.169	15	Sc	999	ug/L	179
Be	234.861	0.0072	---	0.036	15	Sc	1001	ug/L	74
Ca	315.887	0.0288	0.019	---	15	Sc	10.060	mg/L	137
Cd	214.438	0.0196	0.046	0.020	15	Sc	996	ug/L	40
Co	238.890	0.0220	---	0.022	15	Sc	1000	ug/L	66
Cr	205.558	0.0189	0.019	0.019	15	Sc	1000	ug/L	20
Cu	324.764	0.0396	0.030	0.030	15	Sc	1004	ug/L	153
Fe	238.204	0.0217	---	0.036	15	Sc	1004	ug/L	93
K	766.514	0.1395	0.116	0.093	15	Sc	9.959	mg/L	125
Li	670.781	0.1225	0.061	0.082	15	Sc	999	ug/L	138
Mg	279.074	0.0256	---	0.017	15	Sc	10.030	mg/L	101
Mn	257.610	0.0235	---	0.023	15	Sc	999	ug/L	91
Mo	202.031	0.0186	0.037	0.012	15	Sc	1004.5	ug/L	3
Na	588.995	0.1093	0.055	0.036	15	Sc	10.000	mg/L	148
Ni	231.603	0.0213	0.028	0.021	15	Sc	1000	ug/L	52
P	213.618	0.0196	0.033	0.013	15	Sc	5014	ug/L	38
Pb	220.353	0.0202	0.027	0.020	15	Sc	992	ug/L	54
Sb	206.831	0.0252	0.025	---	15	Sc	4987	ug/L	28
Sc	357.253	0.0326	---	0.043	15	N/A	100	%	186
Se	196.026	0.0179	0.012	0.012	15	Sc	5004.5	ug/L	15
Si	251.611	0.0230	---	0.023	15	Sc	4990	ug/L	89
Sn	189.930	0.0174	0.012	0.023	15	Sc	4992	ug/L	4
Sr	407.771	0.0749	0.037	0.050	15	Sc	996.5	ug/L	216
Ti	334.941	0.0306	---	0.041	15	Sc	1000	ug/L	169
Tl	190.794	0.0174	0.017	0.023	15	Sc	1000	ug/L	14
V	292.402	0.0270	---	0.027	15	Sc	1006	ug/L	113
Zn	213.858	0.0196	0.026	0.026	15	Sc	999	ug/L	39

Dashes indicate no Background subtraction point used for this interval.

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14.11 **'Source' conditions** - The source file is used by the Optima to establish the instrument parameters for an analysis. Although more than one source may be used in a run, only one source file may be used for an element file. Currently, we are using a 'compromised' source file, meaning that the conditions listed below are adequate for all of the elements listed in Table 10. Please note that it may be possible to achieve greater sensitivity on a specific element by adjusting the source parameters for that element, although it will cost analysis time.

Rf Power	1180 watts
Nebulizer gas flow	0.900 L/min.
Auxiliary gas flow	1.0 L/min.
Plasma gas flow	14 L/min.
Pump rate	1.0 ml/min.
Equilibration time	15 seconds

14.12 **Format file** - The format file is used to control the format of the real-time data collection and printout. You may change any of the items within this file except for the items with an * next to them; these **must** be present in the format file.

* Summary to	Printer

Summary Detail:

* Individual/Mean	Individual
* Statistics	Mean, SD, CV
Pre-shot data	Yes
Page after sample	No
Data Type displayed	None
* Data type store	Both
* Spectrum storage	All replicates

14.13 **Method file** - The method file contains information that encompasses the entire run. The data file name associated with the analytical run is placed here, as is the read delay, rinse time, etc. The parameters listed below are current as of this writing, and careful consideration should be made before making any modifications.

Read delay	65 seconds
Rinse time	50 seconds
Replicates	2
Data display	None (change freely)
Result name	A unique identifier for a particular run
Spectrum name	Defaults to the result name
Source name	fullscan (Place the current source file name in this space)
Global source	Yes
IEC name	iecelem6 (Place current file name here)
Resolution	Normal
Scanning	No
Processing mode	Area
Integration mode	Auto
Auto integration time	Min.: 10 seconds Max.: 50 seconds

14.14 Set up the analysis on paper using a sample identification weight sheet (ID/WT sheet). This sheet has columns where the operator enters the sample description, corresponding autosampler position number, digestion dilution (if any), and any subsequent dilutions performed on the sample. This sheet must be filled out before continuing with the procedure as it is an integral part of the analysis. A typical starting sequence for the ID/WT sheet is given in Table 11. Please see the group leader or metals lab supervisor if assistance is required in filling out this sheet.

Table 11
ID/WT Sheet Setup for Instrument Calibration and Verification

Sequence Number	Autosampler Position	Sample ID	Solution Name
1	1	is_init	BLANK
2	2	Std OPT A	Std OPT A
3	3	Std OPT B	Std OPT B
4	4	Std OPT C	Std OPT C
5	1	blank	BLANK
6	2	ICS/ICV-A	Std OPT A
7	3	ICS/ICV-B	Std OPT B
8	4	ICS/ICV-C	Std OPT C
9	5	CCV-A	CCV OPT A
10	6	CCV-B	CCV OPT B
11	7	CCV-C	CCV OPT C
12	1	ICB/CCB	BLANK
13	9	IEC-1	IEC-1
14	10	IEC-2	IEC-2
15	11	ICAP-7	Independent check
16	12	IV-19	Independent check
17	13	era1027	Independent check
18	14	Sn 10.0	Independent check
19	15	era3.11	Independent check

14.15 Setup the method parameters.

14.15.1 Enter the method mode by pressing <Ctrl>m. Select the correct method (typically fullscan) and press F5 to edit the method file. Enter the data file that you want to save the results under. The current data file name format is MDDAAAA-X, where:

M is the coded month
DD is the two digit date of the month
AAAA is the matrix that is running (i.e. soil, wtr, TCLP, WW)
X is the alpha representation of the number of runs that have been done under that matrix for that day (i.e. the first run would be 'a', the 5th run would be 'e').

14.15.2 Verify that the IEC data file name is the one that is currently in use. If unsure, please see the metals lab supervisor. If the file is not current, go to that field, type in the correct file name and press <Enter>.

14.15.3 Verify that the data storage mode is correct. Typically, this setting would be at 'YES' for both the result storage and the spectrum storage, although sometimes it is desirable to append to the data file. Set this value according to the needs of the analysis. If you are unsure about this option, see the operator or the metals lab supervisor.

14.15.4 Go into the sample list page by pressing F11.

14.15.5 Enter the sample list as identified on the ID/WT sheet. Please refer to the Optima 3000 software manual for data entry procedures. When entering the data for the sample list, press F12 often to save the sample list. When the sample list is completely entered, press <Shift>F12 to go back to the previous page. If the software asks if you want to save it, follow the directions and save it. Press <Shift>F12 to go back to the main page.

14.16 Begin the analysis.

14.16.1 Type in the method file name that was just edited. Press <Shift>F5 to enter the analysis startup page. The computer will announce that it is entering an analysis, follow the instructions on the screen.

14.16.2 The computer will now bring up a screen that contains information on the conditions for the pending run. Verify that the information is correct, particularly the data file name.

14.16.3 Press F7 to enter the 'Auto' mode, which means that the computer will control the autosampler. Other options are available from this screen, but are not within the scope of this SOP. Please refer to the Optima 3000 Software Manual for additional information on these advanced features.

14.16.4 Change the rinse solution located in position 0 to the blank solution that will be used for calibration. By matching the acid concentrations of the rinse to the analysis, the stability of the plasma is increased.

14.16.5 Press F6 to begin the analysis. The autosampler will go to position 0 and the pump will turn on fast to flush the system with blank solution. The autosampler will then move the probe to the position that corresponds to the first analysis sequence within the sample list in the method file.

NOTE: The autosampler position and the analysis number **are not the same.** The autosampler position number refers to a physical location within the autosampler tray. The analysis number refers to the sequence in which the autosampler will be moved. Typically, the sequence number is sequential (unless a sample is manually repeated). Autosampler position numbers need not be sequential and often are not in order. Please see the Optima 3000 Software manual for a further discussion on the difference between autosampler position number and sequence number.

14.16.6 At any time, the analysis may be canceled and resumed by the operator.

14.16.6.1 To stop the autosampler after it has completed the current analysis, press F7 (Halt). The instrument will complete all of the replicates for the current sample, return to the rinse position, and wait.

14.16.6.2 To stop the analysis immediately, press F8 (Stop). The autosampler will return to the rinse position and wait. Data for the current sample will probably not be valid.

14.16.6.3 To resume the aborted analysis at the next uncompleted analysis, press F6. The autosampler will rinse the probe, then go to the next sample that has not been completed. If the autosampler was halted, it would continue onto the next sample. If the autosampler was stopped, the autosampler will return to the sample it was stopped on and rerun 2 more replicates.

14.16.6.4 To resume an analysis at another point in the run, type in the **sequence number** for the sample that you want to start at and press F6. The autosampler will go to the correct vial and continue the analysis according to the sample list in the method file.

14.16.7 When the analysis is completed, the autosampler will return to position 0 and wait for operator input.

14.17 Print a report.

14.17.1 Enter the report mode by pressing <Shift>F6

14.17.2 Press F5 to get a list of the available data files.

14.17.3 Move the cursor so that it points to the file that is to be printed. Press <Insert> (select).

14.17.4 Press F5 to list the available element files for that data file

14.17.5 Select the desired elements for reporting by moving the cursor to point to them and pressing <Insert>. You may select all of the files by pressing * (the asterisk key) <Insert>

14.17.6 Enter the report format mode by pressing F8.

14.17.7 Adjust the reporting options to fit the needs of the report. Some typical selections are:

Mean ONLY *or* **INDIVIDUAL**
Page after element yes/no
Print by element *or* **Print by sample**
Mean, CV, SD; *or* **Mean only;** *or* **Mean, SD;** *or* **Mean, CV**

14.17.8 Press <Shift>F12 (previous) twice to go to the report file name screen. Press F12 (copy contents), then press F5 (to printer).

14.17.9 When the report has finished printing, press the form feed key on the printer twice to advance the paper.

14.18 Turn in the raw data, ID/WT sheet, and report to the person who is to review the data for repeats, dilutions, etc.

15.0 FLOW CHART

Not applicable.

16.0 CALCULATIONS/DATA HANDLING

16.1 The concentration of each sample is read directly from the computer printout. Dilution factors should be taken into account in the ID weight file.

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16.1.1 Assuming that the instrument did not correct a concentration due to analyst error, the following calculation would be used:

$C_{Final} = C_{Instr} * DF_{Digest} * DF_{Subseq}$,, where

C_{Final} is the final reported concentration of the analyte
C_{Instr} is the concentration as read from the instrument data printout
DF_{Digest} is the digestion dilution factor
DF_{Subseq} is any dilution done subsequent to the digestion dilution

16.2 All samples should be reported to the correct number of significant figures. The significant figure truncation should not be performed until all data calculation have taken place.

16.2.1 Solid samples must be reported in mg/kg.

16.2.1.1 For sample concentrations <100 ppm, report 2 significant figures.

16.2.1.1 For sample concentrations ≥100 ppm, report 3 significant figures.

16.2.1.1 For QC always report one additional significant figure.

16.2.2 Aqueous samples for all metals except Ca, Mg, K, and Na must be reported in ug/L.

16.2.2.1 For sample concentrations <10 ppb, report 1 significant figure.

16.2.2.2 For sample concentrations ≥10 ppb and <1000 ppb, report 2 significant figures.

16.2.2.3 For sample concentrations ≥1000 ppb, report 3 significant figures.

16.2.2.4 For QC always report one additional significant figure.

16.2.3 Aqueous samples for Ca, Mg, K, and Na must be reported in mg/L.

16.2.3.1 For sample concentrations <100 ppm, report 2 significant figures.

16.2.3.2 For sample concentrations ≥100 ppm, report 3 significant figures.

16.2.3.3 For QC always report one additional significant figure.

16.2.4 Extracted samples for all metals must be reported in mg/L.

16.2.4.1 For sample concentrations <0.01 ppm, report 1 significant figure.

16.2.4.2 For sample concentrations ≥0.01 ppm and <1.00 ppm, report 2 significant figures.

16.2.4.3 For sample concentrations ≥1.00 ppm, report 3 significant figures.

16.2.4.4 For QC always report one additional significant figure.

17.0 DATA REPORTING

17.1 See appendices F, H, I, and J for data reporting.

18.0 QUALITY CONTROL

18.1 All quality control data should be maintained and available for easy reference or inspection.

18.2 Linear range studies must be performed every year or when there is a significant change in the instrument response.

18.2.1 To perform a linear range study, calibrate the instrument as it would be calibrated for an actual analysis.

18.2.2 Run standards at high concentrations and calculate the percent recovery for each element. A good place to start is 100 ppm.

18.2.3 If the percent recovery is acceptable (90%-110%), run a standard at a higher concentration. If the percent recovery is not acceptable, run a standard at a lower concentration.

18.2.4 The last standard concentration that had a percent recovery within the acceptance window will be designated as the linear range for that element.

18.3 IDL/MDL studies must be performed on an annual basis.

18.3.1 To calculate an IDL, aspirate ten vials of Blank solution in series. Calculate the standard deviation of a small population, and multiply this result by three. There is also a spreadsheet located on the computer network that will perform this calculation for you. Please see the metals lab supervisor if you need assistance in using this program.

18.3.2 To calculate an MDL, aspirate ten vials of a low concentration standard, typically at a concentration at or near the detection limit. Calculate the standard deviation of a small population and multiply the result by the Student's T value for (n-1) degrees of freedom. If the concentration of the standard ran is greater than ten times the calculated MDL, and the concentration of the standard ran is above the detection limit reported to clients, the MDL must be performed at lower concentration. If the standard concentration is less than ten times the calculated MDL or if the standard used for the analysis was at or below the lowest reporting limit on LIMS, the MDL is acceptable. There is also a spreadsheet located on the computer network that will perform this calculation for you. Please see the metals lab supervisor if you need assistance in using this program.

18.4 Interelement correction factors must be updated annually.

18.4.1 Interelement correction factors must be used on the P 400 when the Interelement Correction Standard does not recover within the limits of 80% to 120%. When an interelement interference causes the IEC standard to recover out of these control limits, interelement correction factors must be used after the analysis to compensate for the interference.

18.4.3 To update or create factors, pure single-element standard solutions of interfering elements are aspirated into the instrument at levels equivalent to those found in samples. The instrument measures the intensity of all of the analytes and the intensity of the interfering element. The ratio of false analyte intensity to interfering element intensity is called the interelement correction factor by the P 400. The factors may be positive or negative depending on if the interfering element causes a false positive or false negative reading at the analyte.

18.5 Dilute and reanalyze samples that are more concentrated than the established linear range.

18.6 Include a minimum of one laboratory blank per sample batch to determine if contamination or any memory effects are occurring. This laboratory blank must be carried through the sample preparation procedure.

18.7 Analyze one matrix spike (MS) and one matrix spike duplicate (MSD) at a frequency of at least 1 in 20 (5%). MS and MSDs are aliquots of sample into which a known quantity of analyte is pipetted in. The percent recovery of the analyte is calculated. This measures the accuracy of the sample preparation method as well as the effect of the matrix on the analysis. The relative percent difference is calculated from the MS and MSD concentrations. The MSD checks the precision of the method.

18.7.1 Pretreated samples must be spiked at the time of digestion before the digestion has begun. Please see the specific pretreatment procedure for a discussion on spiking procedures.

18.7.2 Samples that require dilutions that have an MS/MSD performed on them must also have an MS/MSD performed on an aliquot of the dilution.

18.7.3 Samples not requiring pretreatment are spiked before they are physically loaded on the tray.

18.7.3.1 Currently, there are four 'spiking solutions' used to perform the addition of analyte to the sample. These are designated as SS1, SS2, SS3, and 50 ppm Ag. These solutions are stable by themselves, but due to the high concentrations involved would not be compatible together.

18.7.3.2 See Appendix A for the method used to spike samples.

18.7.3.3 See Table 12 for the final spike concentration when the spiking method outlined in Appendix A is followed

Table 12 Spiking Solutions Final Concentrations

Element	Aqueous Samples (µg/L)	Solid Samples (µg/L)
Aluminum	5000	5000
Antimony	5000	5000
Arsenic	5000	5000
Barium	1000	5000
Beryllium	1000	1000
Boron	1000	1000
Cadmium	1000	1000
Calcium	25000	50000
Chromium	1000	5000
Cobalt	500	1000
Copper	1000	5000
Iron	5000	5000
Lead	500	5000
Lithium	500	1000
Magnesium	25000	50000
Manganese	500	5000
Molybdenum	1000	1000
Nickel	500	5000
Phosphorus	1000	5000
Potassium	25000	50000
Selenium	5000	5000
Silicon	5000	5000
Silver	1000	1000
Sodium	25000	50000
Strontium	500	1000
Thallium	1000	1000
Tin	5000	5000
Titanium	1000	1000
Vanadium	1000	1000
Zinc	500	5000

18.7.4 Calculate the percent recovery of the MS and MSD as follows,

$$\%R = \frac{C_{Spike} - C_{Orig}}{\text{Spike Quantity}} * 100\text{, where}$$

%R is the percent recovery of the spike
C_{Spike} is the concentration of the spiked sample
C_{Orig} is the original concentration of the sample (the unspiked sample concentration)
Spike Quantity is the quantity of the element spiked into the sample

18.7.5 Calculate the relative percent difference between the MS and MSD as follows,

$$\%RPD = \frac{C_{MSD} - C_{MS}}{(C_{MSD} + C_{MS})/2} * 100\text{, where}$$

%RPD is the relative percent difference between the MS and MSD
C_{MSD} is the concentration of the MSD as read from the raw data printout
C_{MS} is the concentration of the MSD as read from the raw data printout

18.8 It is recommended that whenever a new or unusual sample matrix is encountered, a series of tests be performed prior to reporting concentration data for analyte elements. These tests, as outlined in 10.8.1 through 10.8.3, will ensure the analyst that neither positive nor negative interferences are operating on any of the analytes to distort the accuracy of the reported values.

18.8.1 **Serial dilution:** If the analyte concentration is sufficiently high (minimally, a factor of 10 above the instrument detection limit after dilution), an analysis of 5X dilution must agree within 10% of the original determination. If not, a chemical physical interference effect should be suspected.

18.8.2 **Matrix spike addition:** An analyte spike added to a portion of a prepared sample, or its dilution, should be recovered within established control limits

(LIMS limits) of the known value. The spike addition should produce a minor level of 10 times and a maximum of 100 times the instrumental detection limit. If the spike is not recovered within the specific limit, matrix effect should be suspected. The use of a standard-addition analysis procedure can usually compensate for this effect.

CAUTION: The standard-addition technique does not detect coincidental spectral overlap. If suspected, use of computer compensation, an alternative wavelength, or comparison of an alternate method is recommended.

18.8.3 **Standard addition:** The standard-addition technique involves adding known amounts of standard to one or more aliquots of the process sample solution. This technique compensates for a sample constitute that enhances or depresses the analyte signal, thus producing a different slope from that of the calibration standards. It will not correct additive interferences which cause a baseline shift. The simple version of this technique is the single addition method, in which identical aliquots of the sample solution, each of volume V_X, are taken. To the first (labeled A) is added a small volume V_S of a standard solution of concentration C_S. To the second (labeled B) is added the same volume V_S of the solvent. The analytical signals of A and B are measured and corrected for nonanalyte signals. The unknown sample concentration C_X is calculated:

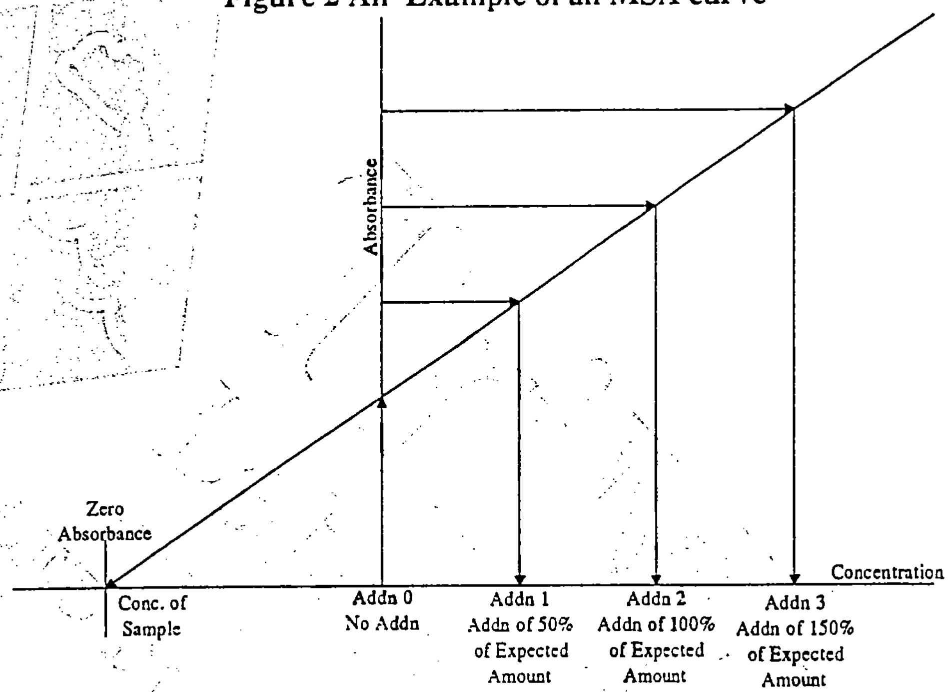
$$C_X = \frac{S_B * V_S * C_S}{(S_A - S_B) * V_X}$$

where S_A and S_B are the analytical signals (corrected for the blank) of solutions A and B, respectively. V_S and C_S should be chosen so that S_A is roughly twice S_B on the average. It is best if V_S is made much less than V_X, and thus C_S is much greater than C_X, to avoid excess dilution of the sample matrix. If a separation or concentration step is used, the additions are best made first and carried through the entire procedure. For the results of this technique to be valid, the following limitations must be taken into consideration:

1. The analytical curve must be linear.
2. The chemical form of the analyte added must respond the same way as the analyte in the sample.
3. The interference effect must be constant over the working range of concern.
4. The signal must be corrected for any additive interference.

The absorbance of each solution is determined and then plotted on the vertical axis of a graph, with the concentrations of known standards plotted on the horizontal axis. When the resulting line is extrapolated back to zero absorbance, the point of interception of the abscissa is the concentration of the unknown. The abscissa on the left of the ordinate is scaled the same as on the right side, but in the opposite direction from the ordinate. An example of a plot so obtained is shown in Figure 2.

Figure 2 An Example of an MSA curve



NOTE: A method of standard addition must be performed on any TCLP sample whose spike recovery is not greater than 50%.

18.9 Check the instrument standardization by analyzing appropriate quality control check standards as follows.

NOTE: Steps 18.9.2 through 18.9.6 must be performed every time the instrument is calibrated.

18.9.1 Calibrate the instrument using a standard and a blank.

18.9.2 An ICS/ICV (Initial Calibration Standard/Initial Calibration Verification) is placed after the calibration standard and blank. Percent recovery limits are

95% to 105% of the original calibration standard concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis.

18.9.3 A CCV (Continuing Calibration Verification) is placed after the ICS/ICV in each run. Percent recovery limits are 90% to 110% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis.

18.9.4 An ICB/CCB (Initial Calibration Blank/Continuing Calibration Blank) is analyzed after the first CCV. The results of this blank are to be within ± the detection limit. If the blank is not within ± the detection limit for an element that must be analyzed, terminate the analysis, correct the problem, and restart the analysis from the beginning.

18.9.5 An IEC (InterElement Correction) standard is analyzed at the beginning and end of each run and every 8 hours of instrument operation. This standard is used to verify the absence of significant spectral interferences and to audit the interelement correction factors. Percent recovery limits are 80% to 120% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the beginning.

18.9.6 An LCS (Laboratory Check Standard), which must come from a different primary source than the calibration standards, is placed after the first CCV in each run. Percent recovery limits are 80% to 120% of the concentration unless control limits have been established. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the beginning. See Table 13 for a tabulation of the

LCS concentrations as of this writing. Dashes in the table indicate that the element to the left is not present in the solution.

Table 13 LCS Concentration When Diluted According to Instructions

Element	SP1036 (µg/L)	SP1037 (µg/L)
Aluminum	1000	---
Antimony	---	2000
Arsenic	1000	---
Barium	1000	---
Beryllium	1000	---
Boron	1000	---
Cadmium	1000	---
Calcium	10000	---
Chromium	1000	---
Cobalt	1000	---
Copper	1000	---
Iron	1000	---
Lead	1000	---
Lithium	1000	---
Magnesium	10000	---
Manganese	1000	---
Molybdenum	---	2000
Nickel	1000	---
Phosphorus	1000	---
Potassium	10000	---
Selenium	1000	---
Silicon	---	2000
Silver	1000	---
Sodium	10000	---
Strontium	1000	---
Thallium	1000	---
Tin	---	2000
Titanium	---	2000
Vanadium	1000	---
Zinc	1000	---

18.9.7 Verify the calibration after every 10 samples.

18.9.7.1 A CCV (Continuing Calibration Verification) is analyzed after every 10 samples, or sooner. Percent recovery limits are 90% to 110% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCV or ICS/ICV.

18.9.7.2 A CCB (Continuing Calibration Blank) is analyzed after the CCV. The results of this blank are to be within ± the detection limit. If the blank is not within ± the detection limit for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCB or ICB/CCB.

18.9.8 At the end of each run, verify the calibration.

18.9.8.1 A CCV (Continuing Calibration Verification) is analyzed at the end of each run. Percent recovery limits are 90% to 110% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCV or ICS/ICV.

18.9.8.2 A CCB (Continuing Calibration Blank) is analyzed after the CCV. The results of this blank are to be within ± the detection limit. If the blank is not within ± the detection limit for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the last good CCB or ICB/CCB.

18.9.8.3 An IEC (InterElement Correction) standard is analyzed at the end of each run. This standard is used to verify the absence of significant spectral interferences and to audit the interelement correction factors. Percent recovery limits are 80% to 120% of the concentration. If the percent recovery for this standard is not within the acceptance limits for an element that must be analyzed, terminate the analysis, correct the problem, recalibrate, and restart the analysis from the beginning.

19.0 ANALYST CERTIFICATION/METHOD VALIDATION

Please see section 3.8.3 and 3.9.3.2 of the TriMatrix Quality Assurance Manual and Appendix E for analyst and method certification/validation protocols.

20.0 REFERENCES (ADDITIONAL)

20.1 Optima 3000 Software Guide; Perkin Elmer Corporation; Manual 0993-8729, Release C; May, 1993.

20.2 Optima 3000 Hardware Guide; Perkin Elmer Corporation; Manual 0993-8744; Release B; March, 1993.

20.3 QC Expert For The Optima 3000; Perkin Elmer Corporation; Manual 0993-8931; Release A; September, 1993.

21.0 APPENDIXES

See Attached

Approved By: SJ 4-4-96 QA/QC Supervisor
Approved By: BJO 4-4-96 Area Supervisor

LOW FLOW PURGING AND SAMPLING SOP

PURGING PROCEDURES

- Measure depth-to-Water and Depth-to-Bottom of each well

- Calculate one volume of the screened or open intervals as performed in the following example (if using packer):

  10 foot screen, 2-inch well diameter = 10 feet x 0.1632 gallons/foot = 1.632 gallons/volume
  1.63 gallons x 3.785 liters/gallon = 6.17 liters or 6.17 liters x 1,000 mls/liter = 6171 mls
  Assuming 200 mls/min purge rate: 6171 mls ÷ 200 mls/min = 30.85 minutes to purge one volume

  Calculating the purge volume will be helpful in determining when stability of the water-bourne constituents can be expected.

- Lower pump to the mid-point of the screened interval.

- Inflate packer (if used) just above top of screen to isolate the screened interval.

- Begin to purge well. USEPA recommends a purge rate of 200 to 300 mls/min. Actual purge rates will be site specific. If the packer is not used, the purge rate should not exceed the recharge rate (i.e., no drawdown in static water level).

- Measure pH, Temperature, Conductivity, Redox Potential and Dissolved Oxygen with a flow-through cell at 3 to 5 minute intervals. Also measure Turbidity, at 3 to 5 minute intervals. These parameters should begin to stabilize before one-half the screened area volume is removed.

- Once the following conditions occur over 3 consecutive readings, sampling can begin:

  - pH stabilizes to within 0.1 units

  - Temp, Redox, D.O. and Turbidity have stabilized to within 10%

  - Conductivity has stabilized to within 10%

  Note: In Region III, Conductivity should be within 3%.

SAMPLING PROCEDURES

- Using the well purging pump already in place, reduce flow rate to 100mls/min for VOCs and sample out of the pump discharge line. The sampling rate can be increased to 200-300 mls/min for the remaining parameters. The flow-through cell should be disconnected or bypassed during sample collection.

- Fill sample containers for appropriate analyses in the following order:

  1. Volatile organics and total organic halogens
  2. Dissolved gases and total organic carbon
  3. Semivolatiles
  4. Metals and cyanide
  5. Major ions
  6. Radionuclides

- At completion of sampling, the packer will be deflated (if used) and the pump removed.

DECONTAMINATION OF EQUIPMENT

- The pump will be disassembled and components (including the packer, if used) will be decontaminated in the following manner for sites with organic contaminants:

  - Alconox and water wash;
  - Tap water rinse;
  - Methanol (or acetone) rinse;
  - Triple distilled water rinse; and
  - Air dry and store pump in plastic

The following decontamination procedures will be followed when working at sites with inorganic contaminants:

- Alconox and water wash;
- Tap water rinse;
- Hydrochloric Acid rinse (0.1N);
- Triple distilled water rinse; and
- Air dry and store pump in plastic

When working at sites with both organic and inorganic contaminants, the first procedure (for organic contaminants) should be followed with the HCI rinse followed by a distilled water rinse added after the tap water rinse.

After decontamination of the pump and components (including the packer, if used), two volumes of distilled water will be flushed through the pump assembly to ensure all decontamination fluids have been removed. This volume is approximately 0.75 gallons. It is beneficial to pump the distilled water at high speed to effectively remove decon. solutions.

This SOP was developed based on articles by the USEPA and various experts in the field including Barcelona, Puls, Korte, and Kearl. This SOP may be edited periodically based on new research and regulatory requirements.

REFERENCES

USEPA (November 1992) RCRA Ground-water Monitoring: Draft Technical Guidance. Office of Solid Waste EPA/530-R-93-001

Kearl, P.M., Korte, N.E., and T.A. Cronk (1992) Suggested Modifications to Ground Water Sampling Procedures Based on Observations from the Colloidal Borescope

Puls, R.W., and M.J. Barcelona (1995) Low-Flow (minimal drawdown) Ground-water Sampling Procedures. USEPA Office of Research and Development EPA/540/s-95/504

PROCEDURE NO. 5

ELECTRONIC WATER LEVEL INDICATOR

1.0 INTRODUCTION

This document describes the general procedures for acquiring static water levels in wells. The electronic water level indicator gives an audible signal or meter reading when the probe at the end of the tape completes an electric circuit by contacting water. The tape is divided into measured increments. Water level measurements should be taken to the nearest .01 foot.

2.0 PROCEDURES

2.1 PREPARATION

Prior to beginning a field investigation, the staff personnel who will be operating the equipment will complete the following tasks:

1. Coordinate schedules/actions with supervisor.

2. Schedule equipment use with FEM.

3. Pick-up equipment on scheduled date and inspect equipment with FEM.

4. Ensure the proper operation of equipment prior to leaving for the site (this includes having fully charged batteries).

2.2 OPERATION

The following procedures will be used to measure static water levels with an electronic tape:

1. Check the probe and tape for visible contamination and decontaminate both between each measurement location following Procedure 6.

2. Lower the probe into the well by pulling the tape from the hand held reel. When raising and lowering the tape, take care not to rub it against the top of the well casing, which can strip insulation off of the wires.

3. As the tape is lowered, straighten any kinks or bends in the tape which may alter the length the tape.

4. Continue lowering the tape until the audible signal is heard.

5. Raise and lower the tape a short distance to confirm the point at which water is contacted.

6. Measure and record the length of tape in the well to the nearest .01-foot; measure from the established monitoring point at the top of the well casing.

7. Record the well number or location, date and time of measurement, field inspector initials, water level measurement, total depth of the well, and any problems, unusual measurements, or damage to the well in the field logbook.

If the electronic water level indicator does not appear to work, check the following items:

- Turn on the probe and press the test button to confirm that the unit is working.

- If the test button does not activate the tone, turn on the probe and dip the tip in water to see if the test button is malfunctioning.

- Check and replace the battery if necessary which is located inside the reel.

- If the probe still does not work, return the unit to the manufacturer.

If the electronic water level indicator works intermittently, or the probe feels like it has contacted water but provides no indication, check the following items:

- Carefully check the condition of the plastic-coated wires (tape) which attach to the probe. If the insulation on these wires appears to be damaged, return the probe to the office. Make a note of this condition on any records of water level measurements. Damaged insulation may produce erroneous water level measurements.

- Check the probe for the presence of free-phase hydrocarbons, such as oil or gasoline, which may float on top of the water. These hydrocarbons are non-conductive, and will not activate the electric probe. Make a note of the presence of free-phase hydrocarbons on any records of water level measurements.

2.3 DATA REDUCTION AND INTERPRETATION

Water level measurements will be subtracted from the elevation of the established monitoring point on the top of the well casing. This will provide the actual static water level in the well in terms of the established elevation datum (preferably mean sea level). If measurements are obtained in the same water zone, the hydraulic gradient and flow direction of the water zone can be determined.

2.4 POST OPERATION

2.4.1 Field

If the equipment has come in contact with contaminated materials, decontaminate all equipment as described in Procedure 6. Always decontaminate the probe and tape after every use.

Prior to leaving the site each day the following items will be completed:

1. Record all observations and notes in the logbook.

2. Complete all logbook entries which will include: project name and number, date, field time, personnel, visitors on-site, weather conditions, site conditions and any other pertinent data.

3. Review logbook entries and verify accuracy of entries. Sign the last page of the days' entry.

2.4.2 Office

When returning the instrument and supplies to the FEM, the following items will be completed.

1. Report any equipment malfunction and/or damage.

2. Copy field logbook and any field maps for project file.

PROCEDURE NO. 6

EQUIPMENT DECONTAMINATION

1.0 INTRODUCTION

Decontamination procedures are performed to ensure that no contaminants are introduced into samples, spread across the site, or carried between sites. In general, equipment decontamination should be performed on-site at the start of the site activities, between sampling events, and at the completion of the site activities. A known contaminated site location will be sampled last to reduce the chance of cross contamination with "clean" areas. The following sections contain a general discussion of various decontamination procedures.

2.0 PROCEDURES

2.1 PREPARATION

Prior to beginning a field investigation, the staff personnel who will be decontaminating the sampling equipment will complete the following tasks:

1. Coordinate schedules/actions with supervisor.

2. Schedule equipment use with the Field Equipment Manager (FEM).

3. Pick up equipment on scheduled date and inspect equipment with FEM. (This includes having distilled water and standard decontamination solutions.)

4. Ensure that all of the decontamination equipment is assembled prior to leaving for the site. At a minimum this includes the following items:

- Wash pails or tubs (plastic or metal);
- Scrub brushes;
- Paper towels;
- Acetone (pesticide grade) or other appropriate solution
- Latex gloves;
- Plastic trash bags;
- Zip-lock bags;
- Nitric acid solution (if sampling for metals analyses)
- Aluminum foil;
- Plastic sheeting;
- Non-phosphate detergent (such as Alconox);
- Distilled/deionized water; and
- Decon water containers.

2.1.1 Potable Water

A potable water supply is available on the site.

2.1.2 Decontamination Solutions

Decontamination solutions will be collected for QA/QC purposes. The field decontamination solutions will be collected in the appropriate sample jars provided by the laboratory.

2.1.3 Decontamination Station Set Up

A permanent decontamination facility exists on-site. This facility consists of a crushed stone wash pad draining to a collection sump. High pressure water spray decontaminates large pieces of equipment or vehicles.

Smaller equipment items such as bailers, trowels and containers will be decontaminated by establishing a small decontamination station adjacent to the work area. The station will contain the previously listed items.

2.2 STANDARD DECONTAMINATION PROCEDURES

Equipment will be decontaminated using the following sequence:

- Non-phosphate detergent (Alconox) plus tap water wash.
- Tap water rinse
- Distilled/deionized water rinse
- 10 percent nitric acid rinse*
- Distilled/deionized water rinse*
- Acetone (pesticide grade) rinse**
- Total air dry or pure nitrogen blow out**
- Distilled/deionized water rinse**

* Only if sample is to be analyzed for metals.

** Only if sample is to be analyzed for organics.

Whenever possible samplers should be numbered in a manner that will not affect their integrity and wrapped in a material (e.g., aluminum foil) that has either been autoclaved or cleaned in the same manner as the sampler. Equipment should be custody sealed and information concerning decontamination methodology, date, time, and personnel should be recorded in the field log book.

The use of distilled/deionized water commonly available from commercial vendors may be acceptable for sampling equipment decontamination provided that it has been verified by laboratory analysis that the water has been distilled and deionized.

2.3 DISPOSAL OF DECONTAMINATION SOLUTIONS AND SUPPLIES

Disposable equipment and supplies will be left at the work site in appropriate containers. Proper disposal of the waste will be arranged by Gould's representatives.

Decontamination solutions can usually be placed on the landfill surface as dust control, away from any test wells or areas where future soil tests might be collected.

PROCEDURE NO. 7

pH METER

1.0 INTRODUCTION

This document describes the general procedures for acquiring the pH and temperature of solutions.

The following quality assurance procedures apply to all water quality instruments used during data acquisition.

1. All water quality instruments will be operated according to operating instructions supplied by the manufacturer. A copy of the operating manual will be kept with the instrument.

2. Battery voltage levels for all instruments will be monitored each day. Batteries will be charged or replaced when voltage levels fall below the level specified by water quality equipment manufacturers.

3. All water quality instruments will be calibrated monthly by the field equipment manager (FEM). Calibration records will be maintained in the office where the instrument is stored. More frequent calibrations may be necessary if field measurements indicate possible instrument malfunction.

2.0 PROCEDURES

2.1 PREPARATION

Prior to beginning a field investigation, the staff personnel who will be operating the equipment will complete the following tasks:

1. Coordinate schedules/actions with supervisor.

2. Schedule equipment use with FEM.

3. Pick-up equipment on scheduled date and inspect equipment with FEM. (This includes having distilled water and standard solutions to calibrate the meter.)

4. Ensure the proper operation of equipment prior to leaving for the site (this includes having fully charged batteries).

2.2 OPERATION

2.2.1 Calibration

The following two-buffer calibration will be done prior to each day in which the instrument is used in the field.

1. Slide power switch on meter to the on position.

2. Slide mode switch to pH. If LO BATT indicator on LCD remains on, battery must be replaced.

3. Attach shorting plug (BNC connector) to connector on top of meter. Slide mode switch to pH. Adjust CALIB. knob to read a 7.00.

4. Remove shorting plug and attach pH electrode probe to connector.

5. Plug temperature probes (ATC) into the two input jacks to the left of the electrode probe on meter.

6. Select two buffers.

7. Place the pH electrode probe and temperature probe in one of the buffer solutions to a depth of two cm and stir moderately. Allow reading to stabilize and set temperature control (°C/slope) to the temperature of the solution. Adjust calibration until the display indicates the pH of the buffer at the solution temperature.

8. Remove both probes from the first buffer solution and rinse by stirring moderately in distilled water. Shake off excess drops of water.

9. Place both probes and ATC probe in the second buffer solution to a depth of about two cm and stir moderately. Allow reading to stabilize and adjust the slope control until the pH of solution temperature is displayed.

10. Rinse both probes with distilled water.

11. Place both probes in first buffer solution to see if meter is holding its calibration. Allow reading to stabilize and if reading is greater than 1%, recalibrate.

12. Rinse both probes in distilled water.

2.2.2 Data Collection

Samples will be collected in the field in clean unused sample jars and tested immediately. The following procedures will be followed:

1. Place electrode probe and ATC probe in unknown sample and allow reading to stabilize. Set temperature control to temperature of sample. Read the pH of sample and pick a buffer solution nearest to the reading.

2. Remove probes from sample and rinse by stirring moderately in distilled water.

3. Place probes into selected buffer and allow reading to stabilize. Set temperature control to temperature of buffer. Adjust CALIB knob on meter if necessary to equal pH of buffer.

4. Remove probes and rinse by stirring moderately in distilled water.

5. Re-measure the unknown solution by placing probes in the solution and allowing the reading to stabilize.

6. Record location, date, time, operator, and results in the field logbook.

2.2.3 Data Reduction and Interpretation

There is no data reduction required for this instrument. Because the instrument measures indicator parameters, interpretation of data is straightforward.

2.3 POST OPERATION

2.3.1 Field

If the equipment has come in contact with contaminated soils or materials, decontaminate all equipment as described in Procedure 6. If the equipment has become dirty, be sure to clean off visible dust or dirt. Always clean probes with distilled water and wrap with damp paper towel immediately after every use. Damage can occur to the electrode if an acidic, alkaline, or organic rich solution is left on the electrode.

Prior to leaving the site each day the following items will be completed:

1. Record all observations and notes in the logbook.

2. Complete all logbook entries which will include project name and number, date, field time, personnel, visitors on-site, weather conditions, site conditions and any other pertinent data.

3. Review logbook entries and verify accuracy of entries. Sign the last page of that day's entry.

2.3.2 Office

All water quality instruments will be cleaned in the laboratory by the FEM before the instrument is used again. When returning the instrument and supplies to the FEM, the following items will be completed:

1. Report any equipment malfunction and/or damage.

2. Copy field logbook for project file.

3. Copy any field maps used for project file.

REFERENCE SOURCES

Operating Manual for pH meter, Orion

Orion Research Incorporated
Laboratory Products Group
529 Main Street, Boston, MA 02129
Telephone (617) 242-3900

PROCEDURE NO. 8

SPECIFIC CONDUCTIVITY METER

1.0 INTRODUCTION

This document describes the general procedures for measuring the specific conductivity of solutions. The meter displays conductivity in five ranges from 0 to 20,000 micromhos/centimeter (umhos/cm) and has an internal thermistor for automatic temperature compensation.

The following quality assurance procedures apply to all water quality instruments used during data acquisition.

1. All water quality instruments will be operated according to operating instructions supplied by the manufacturer. A copy of the operating manual will be kept with the instrument.

2. Battery voltage levels for all instruments will be monitored each day. Batteries will be charged or replaced when voltage levels fall below the level specified by water quality equipment manufacturers.

3. All water quality instruments will be calibrated monthly by the field equipment manager (FEM). Calibration records will be maintained in the office where the instrument is stored. More frequent calibrations may be necessary if field measurements indicate possible instrument malfunction.

2.0 PROCEDURES

2.1 PREPARATION

Prior to beginning a field investigation, the staff personnel who will be operating the equipment will complete the following tasks:

1. Coordinate schedules/actions with supervisor.

2. Obtain appropriate permission for site access.

3. Schedule equipment use with FEM.

4. Pick-up equipment on scheduled date and inspect equipment with FEM. (This includes having distilled water and standard solutions to calibrate the meter.)

5. Ensure the proper operation of equipment prior to leaving for the site (this includes having fully charged batteries).

2.2 OPERATION

2.2.1 Calibration

1. With the meter off, adjust the zero adjustment screw located on the face of the meter so the needle indicates zero.

2. Turn the instrument switch to BATT+, then BATT-, to see if the needle is in the battery OK range. If not, replace batteries.

3. To calibrate the conductivity meter, use a conductivity solution equal to 1,000 umhos/cm.

4. The conductivity probe must be rinsed with distilled water before and after every measurement.

5. Turn the instrument on and connect the conductivity probe. Turn RANGE knob to x10 and put the probe in the calibration solution and adjust the conductivity scale to 1,000 umhos/cm by adjusting the STD knob.

6. If the calibration procedures are ineffective, carefully clean the probe with distilled water and soap and repeat the procedure. If the calibration is still ineffective, internal calibration may be necessary and should be adjusted only by the manufacturer.

2.2.2 Data Collection

1. Turn the RANGE switch to the highest range position (1,000). Rinse the probe with distilled water.

2. Insert the probe into the unknown solution at least one inch without touching the sides or bottom of the container.

3. Decrease the range one step at a time until the meter reading is between 10% and 90% of full scale.

4. It may take several minutes for the reading to stabilize when the temperature of the solution is different from the test environment. The probe will automatically compensate for sample temperatures between 5 degrees Celsius and 45 degrees Celsius.

5. After determining the measurement range, chose a standard within that range and calibrate the meter.

6. Re-measure the unknown solution.

7. Record the sample number and location, date, time, operator, and results in the field logbook.

2.2.3 Data Reduction and Interpretation

There is no data reduction required for this instrument. Because the instrument measures an indicator parameter, interpretation of data are straight forward.

2.3 POST OPERATION

2.3.1 Field

If the equipment has come in contact with potential contaminants, decontaminate all equipment as described in Procedure 6. If the equipment has become dirty, be sure to clean off visible dust or dirt. Always clean the probe with distilled water and wrap with a damp paper towel immediately after each use. Damage can occur to the electrode if an acidic, alkaline, or organic rich solution is left on the electrode.

Prior to leaving the site each day the following items will be completed:

1. Record all observations and notes in the logbook.

2. Complete all logbook entries which will include project name and number, date, field time, personnel, visitors on-site, weather conditions, site conditions and any other pertinent data.

3. Review logbook entries and verify accuracy of entries. Sign the last page of that day's entry.

2.3.2 Office

All water quality instruments will be cleaned in the laboratory by the FEM before the instrument is used again. When returning the instrument and supplies to the FEM, the following items will be completed:

1. Report any equipment malfunction and/or damage.

2. Copy field logbook for project file.

3. Copy any field maps used for project file.

REFERENCE SOURCES

Operating Manual for Conductivity Meter, Cole Palmer

Cole Palmer
7425 North Oak Park Ave.
Chicago, IL 60648
Telephone (312) 647-7600

INSTRUCTION MANUAL

CONDUCTIVITY METER

COLE PARMER
CHICAGO, ILLINOIS 60648

QUICK OPERATION

1. OPEN SHIPPING BOX - TAKE OUT INSTRUMENT
2. ANY DAMAGE?
   -REPORT TO FREIGHT COMPANY
   -CALL DISTRIBUTOR
3. CONNECT CONDUCTIVITY PROBE
4. TURN INSTRUMENT ON (CHECK BATT +, BATT -)
   NOTE: BATTERIES ARE INCLUDED!
5. TURN RANGE SWITCH TO POSITION **x1k**
6. CENTER CAL KNOB
7. RINSE PROBE IN D.I. WATER
8. INSERT PROBE IN SAMPLE
9. DECREASE RANGE SWITCH UNTIL READING IS BETWEEN 10% AND 90% OF SCALE
10. CHOOSE CALIBRATION STANDARD FOR THAT RANGE
11. RINSE PROBE IN D.I. WATER
12. MEASURE CALIBRATION STANDARD, AND ADJUST CAL KNOB FOR CORRECT READING
13. RINSE PROBE IN D.I. WATER
14. MEASURE SAMPLE

-----READ INSTRUCTION MANUAL-----

CONDUCTIVITY METER

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"QUICK OPERATION" (INSIDE FRONT COVER)

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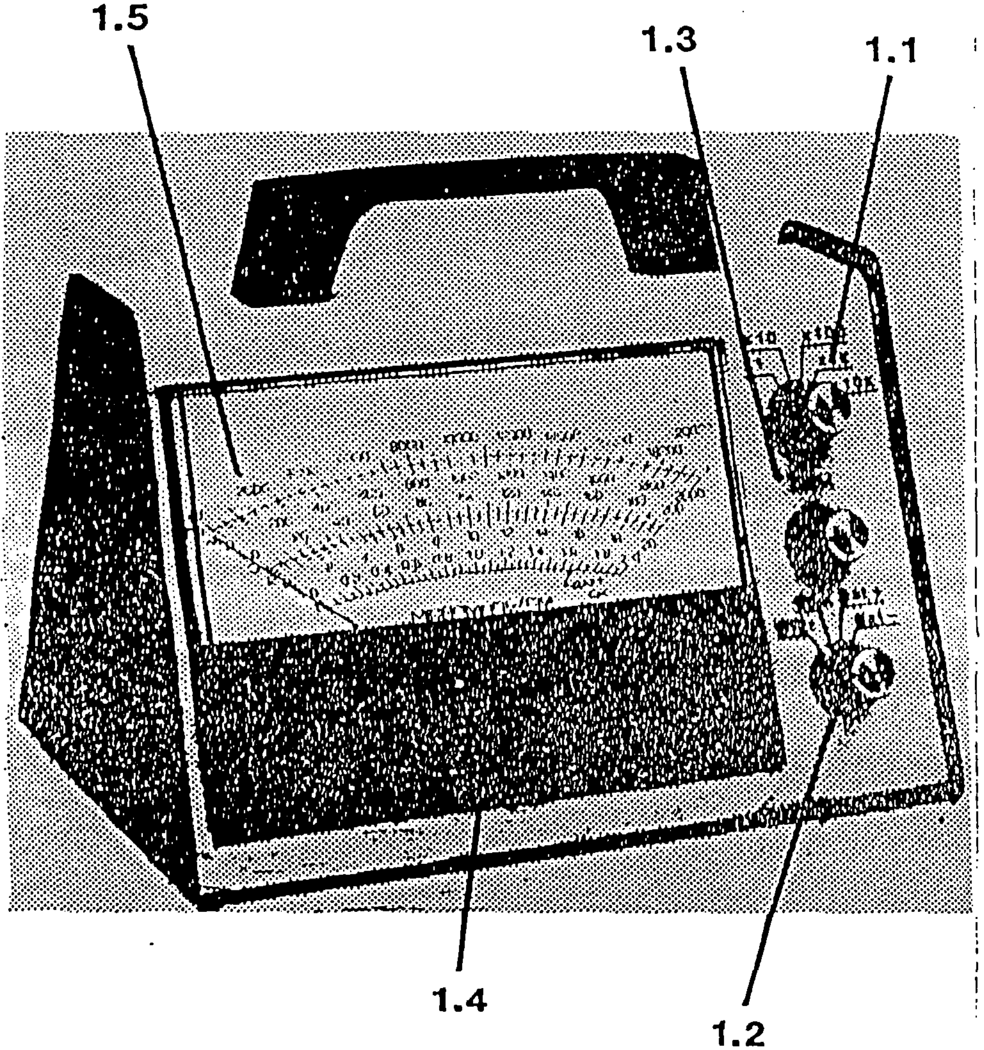
WARRANTY (INSIDE BACK COVER)



1.0 INSTRUMENT FAMILIARITY
(FRONT PANEL)

1.1 **FUNCTION: Off/On/Batt+/Batt-**
Off: Turns power off.
On: Activates meter.
Batt+: Displays pos. battery voltage.
Batt-: Displays neg. battery voltage.

1.2 **RANGE:** Five position switch used to select the proper conductivity scale.

x.1.........0-2 micromhos
x 1.........0-20 micromhos
x 10........0-200 micromhos
x 100.......0-2000 micromhos
x 1k........0-20,000 micromhos

1.3 **CAL:** Adjustment used to standardize meter with conductivity standards.

1.4 **ZERO ADJUSTMENT SCREW:** Zeros analog meter.

1.5 **ANALOG METER:** 0-20 micromho scale. Multiplier on range switch allows for scale conversion. Batt ok scale indicates region where battery voltage is adequate for operation. A reading below the scale indicates batteries need to be replaced.

1.5a **DIGITAL METER:** Digital readout of conductivity and battery voltages. Batt Lo will appear when batteries reach approximately 4.0 volts.

(REAR PANEL)

1.6 **PROBE INPUT:** 5 pin din connector for detachable conductivity probe.

1.7 **POWER:** Input for optional wall plug adapter.

6.0 THEORY

6.1 Conductivity is the measurement of the amount of electrical current that will flow across two noble metal surfaces when a constant voltage is applied. Conductivity is a nonselective measurement with any charged ion contributing to the total conductivity. Organic compounds such as phenols, alcohols, oils, etc., do not dissociate (ionize) in water and therefore have little or no effect on the conductivity. Conductivity is normally expressed as micromhos per centimeter. In the International System of Units (SI) conductivity is expressed as millisiemens per meter, where 1 mS/m is equal to 10 micromhos per centimeter or 1 S/cm is equal 1 micromhos per centimeter.

CONDUCTIVITIES OF SOME COMMON LIQUIDS

Freshly distilled water	.5 to 2.0 micromhos/cm
Potable water	50 to 1500 micromhos/cm
Normal saline	18,400 micromhos/cm

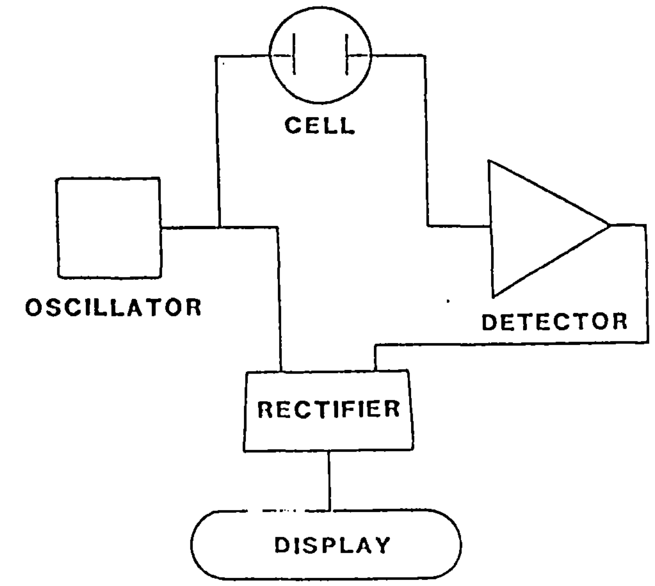
6.2 Conductivity can be used to determine concentration. A nearly linear relationship exists between conductivity and ion concentration for most ionic compounds below 2,000 micromhos/cm. As a result conductivity is often measured to determine total dissolved solids (TDS). It is important to note that this is only a valid methodology when the ionic solution is composed of a pure compound since the exact relationship between conductivity and concentration varies with each ionic compound.

Some examples of the relationship between concentration and conductivity are:

SALT	CONCENTRATION	CONDUCTIVITY (25 degrees C)
Calcium Carbonate (CaCo)	1 G/L (1000 ppm)	2300 micromhos/cm
Sodium Chloride (NaCl)	1 G/L (1000 ppm)	1990 micromhos/cm
Potassium Chloride (KCl)	1 G/L (1000 ppm)	1880 micromhos/cm

7.0 CIRCUIT FUNCTION

An AC voltage is applied to the conductivity cell. The signal passed to the detector is proportional to the resistance and capacitance of the cell and the sample. The synchronous rectifier, which is controlled by the oscillator, corrects for the capacitive effect. A purely conductive reading is displayed.



1. Lab - a. Unscrew (4) feet, remove shroud.
   b. Loose screws on back panel.
   c. Disconnect battery snaps.
   d. Pull battery packs from holder.
   e. Replace all batteries, noting polarity.
   f. Reassemble instrument.

2. Field - a. Remove battery packs from foam insert, disconnect snaps.
   b. Replace all batteries, noting polarities.
   c. Reassemble instrument.

B. If battery checks are ok and meter fails to respond, have instrument serviced.

11.0 SPECIFICATIONS

	71100	71150	71200	71250
READOUT	6" ANALOG METER	3 1/2 DIGIT LCD	6" ANALOG METER	3 1/2 DIGIT LCD
RANGE	0 - 20,000 micromhos			
STEPS	0 - 2, 0 - 20, 0 - 200, 0 - 2000, 0 - 20,000 micromhos			
ACCURACY	+/- 2% Full Scale			
TEMP. COMP.	Automatic 5 - 45 Degrees Celsius			
PROBE	Dip style (platinum plated) not included		Dip style (platinum plated) Included	
SIZE	5" H, 8" W, 5" D		4" H, 12" W, 8" D	
WEIGHT	2.7 lbs. (1.2 Kg)		3.9 lbs. (1.8 Kg)	
POWER	8-1.5 V AA Batt. (std.) 110/220 VAC Adaptor (opt.)		8-1.5 V AA Batteries	

REVISED NOVEMBER 6, 1991

PROCEDURE NO. 9

GROUND WATER SAMPLING

REVISED NOVEMBER 6, 1991

PROCEDURE NO. 9

GROUND WATER SAMPLING

1.0 INTRODUCTION

Collecting ground water samples from wells requires precise procedures to ensure that valid and representative data are generated. The procedures will vary only in terms of the equipment used, with other modifications necessary to address well construction and analytical parameters.

2.0 EQUIPMENT

The equipment used for each sampling event will be dependent on the following general areas:

1. Well construction details; and

2. Analytical parameters.

The equipment used for ground water sampling programs will be capable of purging wells and obtaining samples. In some instances the same piece of equipment (e.g. bailers) can be used for both procedures. However, the use of well purging equipment (e.g.

2. Sample containers
3. Preservatives
4. Ice packs
5. Coolers
6. Personal safety equipment
7. Field and travel blanks
8. Field logbooks
9. Sample labels
10. Chain-of-Custody seals
11. Chain-of-Custody forms
12. Sample analysis request forms

3.0 PROCEDURES

All equipment that enters a well will be properly decontaminated prior to and after each use. Moreover, the equipment will be constructed of relatively inert materials which will not leach or absorb contaminants.

3.1 WELL PURGING

Prior to removing any ground water from a well, the electronic water level indicator will be used to obtain a static water level from each well following Procedure 5.

Once the static water level has been obtained, the volume of standing water in the well will be calculated based on the well diameter and depth. The volume can be calculated with the following formula:

$$V = \pi r^2 h \times 7.48 \text{ gal/ft}^3$$

Where:

V = well volume (gallons)

r = inside well radius (feet)

h = length of water column in well

Alternatively, the following representative volumes for various well diameters can be multiplied directly by the length of the water column.

Inside Casing Diameter	Gallons/Linear Foot
2 inches	.16
4 inches	.65
6 inches	1.47
8 inches	2.61

After the well volume is calculated, a minimum of three well volumes will be removed from the well. The only exception to the minimum purging volume is wells that penetrate water zones that have such limited hydraulic capacity that removing three well volumes is impractical.

Periodic measurements (e.g. every fifth bailer) of pH, temperature and specific conductance will be made as water is purged from the well. The stabilization in these parameters indicates representative formation water has entered the well. If those parameters exhibit significant variability after three well volumes have been removed, additional water will be removed until the parameters stabilize.

Purge water from each well will be placed in a calibrated container in order to determine when three well volumes has been removed. If a pump is used for purging, and a steady flow rate can be maintained, the purged volume can be calculated by timing after the pumping rate is determined. The pumping rate for each well will be determined by evaluating the data collected during the packer tests, rising and/or falling head permeability tests and pump tests.

The selection of well purging equipment will generally be dictated by well diameter, depth, and accessibility. Wells that are 4 inches or larger in diameter, and greater than 25 feet in depth, will be purged with a submersible pump.

3.2 WELL SAMPLING

The sampling device, a dedicated teflon bailer, will be precleaned prior to obtaining the sample. The bailer line (e.g. polypropylene) and disposable gloves will be discarded after sampling each well. Care will be exercised so the bailer line does not contact the ground surface during sampling. The bailer will be slowly lowered into the well to prevent excessive ground water agitation and aeration. Water in the bailer will be poured directly into the sample containers. Ground water samples analyzed for dissolved metals will be field filtered prior to placement in the appropriate container. The appropriate preservatives will be added to the containers after they are filled or added at the laboratory before the containers are sent to the field. The samples will be maintained at 4°C. It will be noted that most pumps are not suitable for sampling due their effects upon samples for chemical analyses.

3.3 FIELD FILTERING

Ground water samples collected for dissolved metals analysis will be field filtered upon sample collection and prior to preservation. Filtration will be performed using disposible .45 micron filters. Particularly turbid samples may be pre-filtered utilizing a glass fiber filter prior to the .45 micron filter to speed the process.

After filtration, the ground water samples will be placed in laboratory supplied containers, preserved with nitric acid to a pH of less than two, placed on ice, and shipped to the contracted laboratory.

3.4 DECONTAMINATION

All sampling equipment, with the exception of disposable bailer lines will be decontaminated following Procedure 6 between each sampling event. Dedicated check valve bottom fill bailers will be used for each well, to allow the bailers to be decontaminated in a controlled environment (e.g. laboratory) after each sampling round is completed.

Submersible pumps, hoses and electric lines will be wiped and then placed into a container with clean water and laboratory detergent. The water and detergent will be circulated through the pump and discharge hose by pumping. A final equipment rinse and circulation will be made with potable water.

Other types of pumps may require disposal of the discharge hose after each well is purged. The pump body, valves, etc. will then be cleaned following Procedure 6.

PROCEDURE NO. 19

SOIL SAMPLING

1.0 INTRODUCTION

There are a wide variety of sampling tools and methods for obtaining soil samples. The proper selection of soil sampling tools and methods will be dependent on a number of factors including soil gradation and density, sampling depths, and contaminants of concern. Soil samples will be collected with hand tools and drilling equipment.

2.0 SHALLOW SOIL SAMPLING

Shallow soil samples will be obtained with shovels, trowels and hand augers. Hand augers will be used to perform shallow borings and collect soil samples for chemical analysis. These soil samples are typically quite disturbed, but are useful for soil classification and to identify the extent of shallow contamination. The effective depth for hand auger borings will vary greatly depending on site conditions, but is typically not deeper than five feet. Hand auger borings are not appropriate for sites with cobbles, hard soils, frozen ground, debris, or soils which tend to cave in.

2.1 EQUIPMENT

The bucket-type hand auger consists of a stainless steel bucket with two cutting edges at the tip. The dutch hand auger is used in clayey soils, and consists of an open double helix arrangement.

The following items will be available when conducting shallow soil sampling:

- Hand auger(s);
- Rods, handle, and pipe wrenches (for hand auger);
- Shovel, pick, and trowel;
- Sample jars and labels;
- Cooler and ice;
- Decontamination supplies and distilled/deionized water;
- Plastic sheeting;
- Containers for mixing composite samples;
- Waterproof magic marker;
- Flagging tape;
- Wooden stakes;
- Folding ruler and measuring tape (50 or 100-foot); and
- HNu or other instrumentation required by the site specific sampling plan.

General Procedures

The following procedures are generally used when sampling with hand augers:

1. The hand auger boring location will be determined from a site plan;

2. Vegetation or loose surface debris which could fall in the hole during augering will be cleared away;

3. One-foot intervals will be marked on the auger rod with a waterproof marker;

4. The hand auger will be decontaminated as appropriate and rinsed in distilled/deionized water;

5. Each interval of soil which is removed will be visually examined for changes in soil type, and will be scanned (e.g. HNu) for any field parameters which may be required by the sampling plan;

6. All observations and depths will be recorded on the hand auger boring log;

7. The marks on the hand auger rod will be used to measure the depths at which samples are collected;

8. Soil samples will be collected at required intervals, or based upon field observations;

9. At the completion of each boring, the hole will be backfilled with soil, or grout if required by a site specific plan;

10. The location of the boring will be measured relative to known site features, or recorded locations on a site plan; and

11. Location and elevations will be surveyed at a later date, the boring locations will be marked with wooden stakes and flagging tape. The boring number will be written on each stake with a waterproof marker.

Sample Collection

Soil samples are generally removed through the top of the bucket auger. Depending on the soil consistency, the auger may be gently tipped upside down, or the auger handle hit on the ground to extract the sample.

Samples collected with a hand auger will often contain debris or soil which may have fallen into the top of the hand auger bucket during the augering process. As the sample is removed from the auger bucket, the upper portion of the sample will be discarded, and not submitted for analysis.

For "grab" samples, the sample will be transferred directly from the auger bucket to the sample jar. For "composite" samples, the auger spoils will be placed into a container and thoroughly homogenized before placing in the sample jar.

Appropriate marking of the sample jars, sample documentation and handling of the samples will be performed as outlined in the respective procedures documents.

All equipment will be thoroughly decontaminated between each boring, and before leaving the site as outlined in the equipment decontamination procedures.

3.0 DEEP SOIL SAMPLING

Deep soil samples are commonly obtained from test pits or through the use of drilling equipment and downhole samplers. The most common type of downhole sampling device is the split spoon sampler.

A split spoon sampler commonly is used for the collection of soil samples at depths greater than five feet. A drill rig will be employed to advance the borehole to the desired sampling depth, using either rotary or hollow stem auger drilling techniques. The sampling plan will reference the specific sampling depths, the frequency of sampling, and volume of soil that is needed. Once the desired depth is reached a decontaminated split spoon sampler will be advanced a specific vertical distance by means of a 140-pound free falling weight (ASTM D 1586).

The split spoon sampler consists of steel tubing split longitudinally and equipped with a drive shoe and head. The sampler is available in a variety of lengths and diameters. Procedure No. 11 discusses the methods used to obtain a split spoon sample.

PROCEDURE NO. 29

SEDIMENT SAMPLING

1.0 INTRODUCTION

The following section outlines the recommended procedures and equipment for the collection of representative sediment samples for chemical analysis from standing lakes, ponds, lagoons, and impoundments, and flowing streams, rivers and channels.

The collection of the sample is highly dependent on site specific conditions. The following factors will be considered prior to collection:

1. Access to the sample location;

2. Flow rate; and

3. Seasonal or tidal fluctuation.

Prior to sample collection, the characteristics of the surface body will be recorded in the field log book. Size, depth, flow, and location of the sample point in the impoundment or river will be recorded in the field log book. In sampling streams, rivers, and channels sampling will proceed from downstream locations to upstream locations so that sample disturbance will not affect sampling quality. Also, if both sediment and water samples are being collected at the same time the water samples will be collected first.

2.0 EQUIPMENT

The sampling of sediment in a lake, pond, lagoon, impoundments, streams, rivers, and channels will be achieved by using the following samplers:

1. Trowel or scoop;
2. Sampling trier;
3. Bucket auger;
4. Soil coring device;
5. Veihmeyer sampler;
6. Split spoon sampler; and
7. Ponar dredge.

The factors that will contribute to the selection of a sampler of the stream bed or impoundment include width, depth, flow, and the bottom characteristics of the stream bed or impoundment and whether the sample will be collected from an off-shore or on-shore location.

In collecting sediment samples, care will be taken to minimize disturbance to the sample and to avoid the loss of liquid and fines associated with the sample. The samplers will not decant off any excess liquid. Any liquid that is collected in the bottle is representative of the sediment conditions.

2.1 GENERAL PROCEDURE

The following sampling procedure will be used in the collection of sediment from the shore or bank:

1. Under dry and/or low flow conditions and if the sampling point is within reach, sediment will be collected with a decontaminated trowel or scoop;

2. Once the sample is obtained, it will be transfered directly into the sample bottle provided by the laboratory;

3. Decontaminate the sampling device following the procedures outlined in SOP 6 before collecting the next sample;

4. If the sampling point is under flowing conditions or is greater than 4 inches in depth, a corer or another device that would minimize sample washing will be used;

5. The soil coring device, sampling trier, and the split spoon sampler will allow for the collection of an undisturbed core of sediment. (Follow the procedures outlined in the manufacturers manual for the specific operation of these sampling devices);

6. A decontaminated trowel should be utilized to transfer the sample from the corer directly into a decontaminated sample bottle; and

7. After the collection of the sample, decontaminate the sampling device following the procedures outlined in SOP 6 before collecting the next sample.

ATTACHMENT C

OF THE

QUALITY ASSURANCE PROJECT PLAN
REFINED METALS SITE

FIELD AUDIT CHECKLIST

ADVANCED GEOSERVICES CORP.
FIELD OPERATIONS AUDIT CHECKLIST

Project/Site Name: ______________________ Project Number: ______________

Date: ________________ Audit Conducted from ______ hour to _______ hour

Audit Team: ___________________________ ____________________________

On-Site Field Personnel: __________________ ____________________________

Audit conducted on the following:

_____ Soil Sampling _____ Groundwater Sampling _____ Health & Safety

_____ Surface Water/Sediment _____ Decontamination _____ Other

Brief description of site activities:

____
____
____
____

Field Logbook Review	Yes	No	N/A
Is the field logbook permanently bound?	______	______	______
Is the field logbook numbered?	______	______	______
Are the pages sequentially number, none missing?	______	______	______
Are all entries made in ink?	______	______	______
Is the end of each entry dated and signed?	______	______	______
Are all blank spaces within the field notes and at the bottom of the page crossed out?	______	______	______

Field Logbook Review (cont.)	Yes	No	N/A
Full name of personnel on-site and their responsibilities noted?	____	____	____
Documentation of agency and client oversight?	____	____	____
Weather conditions noted?	____	____	____
Purpose of operations/description of event included?	____	____	____
Date, time, and details of conversations between team members, client contacts, or other parties documented?	____	____	____
Documentation of approval of any on-site decisions, especially deviations from the approved workplan or QAPjP included?	____	____	____
Field instrumentation used, date and time of calibrations, and any standards used noted?	____	____	____
Field measurement results and person conducting test included?	____	____	____
Date, time, and location of sampling event	____	____	____
Method of sample collection	____	____	____
Sample times, description, identification	____	____	____
Sample Parameters and preservation	____	____	____

Sampling (General)	Yes	No	N/A
Was a copy of the QAPjP available on-site?	____	____	____
Field checklist on hand and followed?	____	____	____
Is a site specific map indicating sampling locations available?	____	____	____

Sampling (General) (cont.)	Yes	No	N/A
Were the sampling locations the same as those specified in the sampling plan?	______	______	______
If no, were proper procedures used to obtain approval of the change?	______	______	______
Was the new location documented in the field logs with reason for change?	______	______	______
Were samples collected as specified in the QAPjP?	______	______	______
Were the appropriate bottles used for sample collection (correct type and size)?	______	______	______
Were sample bottles labeled properly?	______	______	______
Were samples properly preserved?	______	______	______
Were volatile samples collected first?	______	______	______
Were the proper sample volumes procured?	______	______	______
Were correct decontamination procedures used?	______	______	______
Were samples iced while in field and for shipment?	______	______	______
Did potential for cross-contamination exist?	______	______	______
Was the sampling technique consistent for all samples?	______	______	______
Were samples properly packaged for shipment (packed to avoid breakage, sufficient ice packs, and sufficient absorbent material included)?	______	______	______
Were chain-of-custody documents filled out completely (client, location, date, time, matrix, no. of bottles etc.) and packaged with the samples?	______	______	______
Were custody seals initialed and placed on bottles?	______	______	______

Sampling (General) (cont.)	Yes	No	N/A
Was strapping tape used on the coolers and were the coolers adequately labeled?	______	______	______
Was sample custody maintained after sample collection?	______	______	______

Sampling (Soils)	Yes	No	N/A
Were the samples collected at the proper depths?	______	______	______
Were the samples screened with an HNU or OVA?	______	______	______
Was a description of the material documented?	______	______	______
Were VOAs collected prior to homogenization?	______	______	______
Were samples homogenized correctly?	______	______	______

Sampling (Surface Water/ Sediments)	Yes	No	N/A
Were the stream flow and velocity noted?	______	______	______
Was sampling performed downstream to upstream?	______	______	______
Were the samplers standing downstream of sample collection location?	______	______	______
Were samples collected in non-stagnant areas?	______	______	______
Were sediments characterized as to type and size?	______	______	______
Were pH, DO, conductivity and temperature taken?	______	______	______

Sampling (Groundwater)	Yes	No	N/A
Were bailer and bail line dedicated to each well?	______	______	______

Sampling (Groundwater)cont.	Yes	No	N/A
Were the purge water and pump lines decontaminated or disposed properly?	______	______	______
Were well volumes and purge rates properly calculated and documented?	______	______	______

Field Quality Control Samples	Yes	No	N/A
Were field duplicates collected at the proper frequency?	______	______	______
Were field blanks collected?	______	______	______
Were equipment blanks collected for each matrix and all appropriate equipment?	______	______	______
Was the proper water source used for field and equipment blank collection?	______	______	______
Were trip blanks included in the bottle shipment?	______	______	______

Field Measurements	Yes	No	N/A
Was all field equipment calibrated properly and at the frequency required?	______	______	______
Were calibration times and procedures documented in the field logbook?	______	______	______
Were the proper standards used?	______	______	______

Decontamination	Yes	No	N/A
Was the proper decontamination method performed?	______	______	______
Was equipment decontaminated at the proper frequency?	______	______	______

Decontamination (cont.)	Yes	No	N/A
Was equipment dedicated to each sampling location?	______	______	______
Was the proper decontamination area used?	______	______	______

Health and Safety	Yes	No	N/A
Was a health and safety briefing conducted and noted in the logbook prior to start of work?	______	______	______
Was the proper level of personal protection used and documented?	______	______	______
Was the HASP readily available?	______	______	______
Were emergency contacts readily available?	______	______	______
Was monitoring equipment present?	______	______	______
Was a first aid kit readily available ?	______	______	______
Was contaminated clothing disposed of properly?	______	______	______

Overall Comments	Yes	No	N/A
Were the personnel conducting the investigation professional?	______	______	______
Were the project objectives understood by the personnel?	______	______	______
Was the field crew organized?	______	______	______
Was there continuity in the process?	______	______	______
Did weather conditions affect the sample quality?	______	______	______

Audit Summary and Comments

Signed by: ______________________ Print: ______________________

Date: ______________________

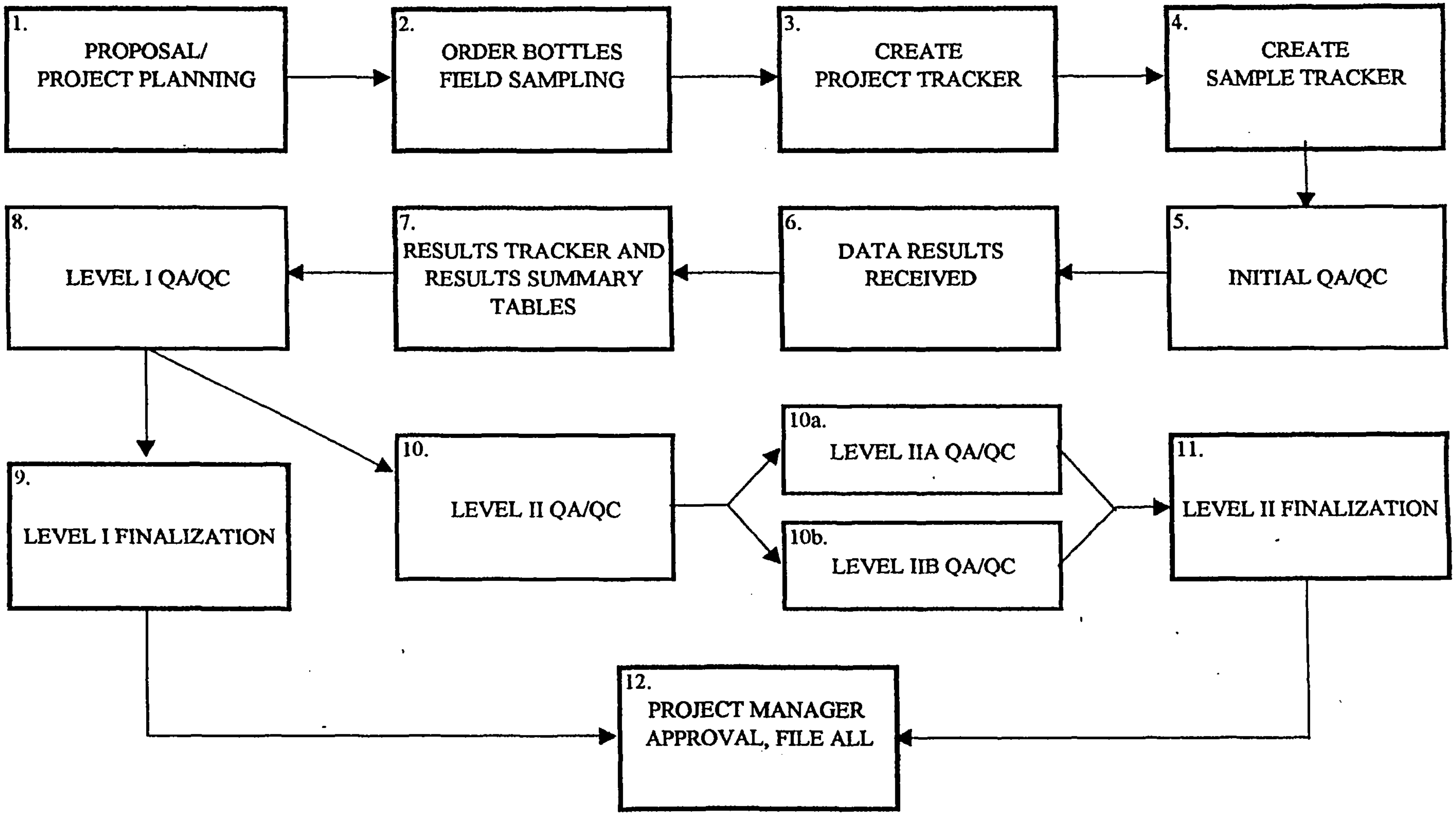
ATTACHMENT D

OF THE

QUALITY ASSURANCE PROJECT PLAN
REFINED METALS SITE

DATA VALIDATION CHECKLIST

AGC ANALYTICAL DATA MANAGEMENT
STANDARD OPERATING PROCEDURES



Level I QA/QC is the minimim data review required for each project.

#. Identifies the Standard Operating Procedure step. Descriptions of each step are found on attached summary.

Indicates a level of QA/QC review.

Dvsop

AGC ANALYTICAL DATA MANAGEMENT
STANDARD OPERATING PROCEDURE

1. PROPOSAL/PROJECT PLANNING
   Initiate sample collection process with Data Validation Specialist. Determine Data Quality Objectives, sampling locations, parameters, analytical methods, data deliverables and schedule.

2. ORDER BOTTLES, FIELD SAMPLING
   Order bottles and set schedule with laboratory. Collect samples.

3. CREATE PROJECT TRACKER
   Add project to Project Tracker (see attached example). Project Tracker will contain project name, number and manager, sample location/ID, sample start and completion date, date results expected, level of QA/QC required and date QA/QC completed. A weekly updated printout of the project tracker will be maintained in the QA area for anyone's review.

4. CREATE SAMPLE TRACKER
   Create sample tracker unless not required for Level I QA/QC (required for Level II QA/QC). The sample tracker will be completed using the chain-of-custody and will include all of the samples collected for a given project. The sample tracker consists of the AGC location/sample ID, laboratory ID, sample matrix, sample collection date, laboratory performing analysis, analytical parameters and methods, and sample-specific notes. An additional tracker can be created for coordinates if provided. An example of a sample tracker is attached.

5. INITIAL QA/QC - all chains of custodies checked against the project specifications.
   Complete an initial QA/QC review (see attached checklist) and file in QA project file.
   Check that the list of parameters is accurate and note any deviations from sampling plan.
   Verify that samples have been collected from all locations specified and note deviations from sampling plan. Verify receipt of samples at analytical lab were in good condition, and inform project manager if major changes are evident.

6. DATA RESULTS RECEIVED
   Upon data receipt, inform project managers unvalidated results are available. Data will be stored in a project file in the QA area with a slip sheet (see attached example) attached describing the review status of the data.

7. RESULTS TRACKER/RESULTS SUMMARY TABLE
   Using laboratory diskette deliverables, import data into results tracker. If diskette deliverables are not supplied, enter results from laboratory data package Form I's. From the database, export the results to data summary tables. The results tracker is required for Level IIA and Level IIB and data summary tables are required for Level IIB only. At a minimum, summary tables will include project name and number, dates of sample collection, sample location/sample ID, parameters analyzed, results, qualifiers, detection limits, qualifier definitions, and signature of QA Scientist.

8. LEVEL I QA/QC
Complete Level I QA/QC review checklist (see attached checklist). Verify all analyses were performed as requested and as per method requested (including detection limits). Verify all samples have reported results for the parameters requested and that there are no extreme results. Verify holding times have not been exceeded. Check field blank contamination, field duplicate precision, total versus dissolved results, and sample data (results and forms) where applicable. If any of the preceding do not comply with QA/QC specifications, request additional information or additional analyses from the laboratory as needed and make necessary qualifications.

9. LEVEL I FINALIZATION
Enter required qualifications into results tracker. If Level I QA/QC is the final QA/QC check required then verify that Level I QA/QC review checklist is complete, update Project Tracker and print out Project Status Form. Copy Level I QA/QC checklist and Project Status Form for project manager to confirm that QA review is complete. Skip to #12.

10. LEVEL II QA/QC
Level IIA or Level IIB Review will be performed.

a. **Level IIA -**
Review uses QA/QC summary sheets supplied by the analytical laboratory. Validation consists of a review of these summary sheets for laboratory blank contamination, matrix spike and matrix spike duplicate recovery, laboratory and field duplicate relative percent difference, QC check sample recovery, and any additional summary forms (calibration, internal standard areas, etc.). Data results are not recalculated or verified.

b. **Level IIB -**
Review consists of a full data validation of a "CLP" or "CLP-like" data package. Validation will include examination of all items listed in a Level IIA validation, in addition to all instrument logs, analyst run logs, and chromatographs. All results will be recalculated and verified. A data validation report will be completed describing the usability of the sample data.

11. LEVEL II FINALIZATION
To finalized data management, a second QA reviewer will verify consistency between reports, checklists, summary tables and databases and perform data and qualifier checks. The project tracker, sample tracker, validation reports, validation spreadsheets and sample results database are finalized. The completed information is copied for the Project Manager for final review.

12. PROJECT MANAGER APPROVAL, FILE ALL

The Project Manager's comments are addressed and, if necessary, data validation reports and summary tables are edited. All data management checklists, tables, and reports are filed in the project file.

PROJECT STATUS CHECKLIST

Project Name: ______________________ Sampling Event/Date(s): ________________

Project Number: ______________________ Laboratory Name: ________________

Project Manager: ______________________

		Date	Initials
1	Project tracker initiated	________	________
2	Samples collected and chain-of-custodies received	________	________
3	1st Internal checklist completed	________	________
4	Fax Recieved	________	________
5	Data deliverables received (Expected on ____________)	________	________
6	Project Manager informed that data results have been received	________	________
7	Sample tracker initiated	________	________
8	Level I QA/QC validation started	________	________
9	Level I QA/QC validation completed	________	________
10	Level II A data validation started	________	________
11	Level II A data validation completed	________	________
12	Level II B data validation started	________	________
13	Level II B data validation completed	________	________
14	Data QA spreadsheets constructed	________	________
15	Level II data validation reports and/or checklists verified	________	________
16	Level II data validation reports and/or checklists finalized	________	________
17	Level II QA/QC data validation qualifiers entered into results tracker	________	________
18	Database entries verified	________	________
19	Data management finalized (project tracker, sample tracker, QA/QC spreadsheets, data validation reports and checklists)	________	________

INITIAL QA/QC REVIEW CHECKLIST

Project Name: ____________________ Sampling Event/Date(s): ____________________

Project Number: ____________________ Laboratory Name: ____________________

Project Manager: ____________________

1 Verify the parameters listed for analyses on the chain-of-custody are consistent with those listed in the Workplan, QA plan, and/or proposal.

Yes ☐ No ☐

Comments/deviations: ____________________

2 Verify the methods listed on the chain-of-custody are consistent with those listed in the Workplan, QA plan, and/or proposal.

Yes ☐ No ☐

Comments/deviations: ____________________

3 Verify all sample locations were sampled, the correct number of samples were collected and the locations are consistent with the Workplan, QA plan, and/or proposal.

Yes ☐ No ☐

Comments/deviations: ____________________

4 Verify the project tracker is updated.

Yes ☐ No ☐

If no, explain: ____________________

5 Verify a project status form is initiated.

Yes ☐ No ☐

If no, explain: ____________________

6 Verify the Project Manager has been informed of any deviations noted on this form.

Yes ☐ No ☐

Additional Comments: ____________________

QA Scientist : ____________________ Date: __________

LEVEL I QA/QC DATA REVIEW CHECKLIST

Project Name: ____________________ Sampling Event/Date(s): ____________________

Project Number: ____________________ Laboratory Name: ____________________

Project Manager: ____________________ Laboratory Case Number: ____________________

1 Verify Initial QA/QC review is complete.

Yes ☐ No ☐

If no, complete initial QA/QC review before proceeding with Level I QA/QC review.

2 Verify the chain-of-custody is present.

Yes ☐ No ☐

Comments: ____________________

3 Verify the sample ID on the chain-of-custody matches the laboratory sample ID.

Yes ☐ No ☐

Comments: ____________________

4 Verify the analyses requested have been performed.

Yes ☐ No ☐

Comments: ____________________

5 Verify the analyses were performed using the requested methods.

Yes ☐ No ☐

Comments: ____________________

6 Verify results were reported for all samples collected and all parameters requested.

Yes ☐ No ☐

Comments: ____________________

7 Verify no extreme results were reported.

Yes ☐ No ☐

Comments: ____________________

QA Scientist : ____________________ Date: ____________

LEVEL I QA/QC DATA REVIEW CHECKLIST

Project Name: ____________ Sampling Event/Date(s): ____________

Project Number: ____________ Laboratory Name: ____________

Project Manager: ____________ Laboratory Case Number: ____________

8 Verify samples were analyzed within holding time criteria.

Yes ☐ No ☐

If no, assign the appropriate qualifiers to the affected sample results.

Qualifiers applied: ____________

9 Verify there is no field, equipment, or trip blank contamination present.

Yes ☐ No ☐ NA ☐

If no, assign the appropriate qualifiers to the affected sample results.

Qualifiers applied: ____________

10 Verify a field duplicate sample was collected and reproducibility is within acceptance criteria.

Yes ☐ No ☐ NA ☐

If no, assign the appropriate qualifiers to the affected sample results.

Field duplicate samples: ____________
Qualifiers applied: ____________

11 Verify that the total metal results are greater than or equal to the dissolved metal results.

Yes ☐ No ☐ NA ☐

If no, assign the appropriate qualifiers to the affected sample results.

Qualifiers applied: ____________

12 Verify Level I QA/QC review is complete.

Yes ☐ No ☐

13 Verify if Level II QA/QC review is required.

No ☐ Level IIA ☐ Level IIB ☐

Additional Comments: ____________

QA Scientist: ____________ Date: ____________

INORGANIC DATA VALIDATION SUMMARY

Site Name: ____________________

Project Number: ____________________

Sampling Date(s): ____________________

Laboratory: ____________________

Case /Order No.: ____________________

Compound List: ☐ TAL ☐ Priority Pollutant ☐ Appendix IX ☐ Other ________

Method: ☐ CLP SOW ILMO4. ☐ 40 CFR 136 ☐ SW-846 Method ☐ Other ________

The following table indicates the data validation criteria examined, any problems identified, and the QA action applied.

Data Validation Criteria:	accept	FYI	qualify	Comments
Holding Times				
Initial Calibrations				
Continuing Calibrations				
CRDL Standards				
Blank Analysis Results				
ICP Interference Check Sample Recoveries				
Duplicate Results				
Field Duplicate Results				
Spike Analysis Recoveries				
Serial Dilution Results				
Laboratory Control Sample Results				
Furnace AA QC Analysis				
Quantitation/Detection Limits				
Overall Assessment of Data				
Other:				

General Comments: ____________________

Accept - No qualification required.

FYI - For your information only, no qualification necessary.

Qualify - Qualify as rejected, estimated or biased

NA - Not applicable.

NR - Not reviewed.

QA Scientist ____________________

Date ____________________

Beech Grove Closure Cost.

HERITAGE ENVIRONMENTAL SERVICES, INC.

HERITAGE

P.O. Box 51020
Indianapolis, IN 46251
Phone: 317/243-7475
FAX: 317/243-2046

REGULAR MAIL

CONFIDENTIAL AND PRIVILEGED:
ATTORNEY-CLIENT AND WORK PRODUCT PRIVILEGES ASSERTED

February 13, 1998

Mr. Matthew A. Love
Manager, Regulatory Affairs
Exide Corporation
645 Penn Street
Reading, Pennsylvania 19601

Mr. Robert N. Steinwurtzel
Swidler & Berlin
3000 K Street, N.W.
Suite 300
Washington, D.C. 20007-5116

Re: **Cost Estimate for Closure of Refined Metals Corporation Hazardous Waste Management Units Heritage Project Number: 28190**

Gentlemen:

Enclosed is the cost estimate for financial assurance purposes to perform closure of the regulated hazardous waste management units at the Refined Metals Corporation facility located in Beech Grove, Indiana.

Please feel free to contact me at (317) 486-2783 if you have any questions, comments, or require further assistance.

Sincerely,

Heritage Environmental Services, Inc.

Craig G. Hogarth, CPG
Senior Project Manager

Enclosure

CLOSURE COST ESTIMATE
FOR DESIGNATED
HAZARDOUS WASTE MANAGEMENT UNITS

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

HERITAGE

Heritage Environmental Services, Inc.

Confidential And Privileged
Attorney Client And Work Product Privileges Asserted

CLOSURE COST ESTIMATE FOR DESIGNATED HAZARDOUS WASTE MANAGEMENT UNITS

REFINED METALS CORPORATION
BEECH GROVE, INDIANA

February 13, 1998

Prepared By:
Heritage Environmental Services, Inc.
1175 Western Drive
Indianapolis, Indiana 46241

Heritage Project Number 28190

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1. INTRODUCTION

The purpose of this document is to provide a cost estimate for the closure of the Hazardous Waste Management Units ("HWMU's") at the Refined Metals Corporation facility located at 3700 South Arlington, Beech Grove, Indiana 46107.

Refined Metals Corporation is currently negotiating a Consent Decree with the United States and the State of Indiana covering environmental management matters primarily pertaining to compliance with the Resource Conservation and Recovery Act ("RCRA"). Based on the proposed Consent Decree, ten (subdivided for convenience) HWMU's were identified at the Refined Metals Corporation facility as requiring RCRA closure in accordance with the requirements of 40 CFR Part 265. Nine of the HWMU's are designated as Waste Piles regulated in accordance with 40 CFR Part 265, Subpart L and one Surface Impoundment regulated at 40 CFR Part 265 Subpart K. Within 30 days after entry of the Consent Decree, Refined Metals must provide financial assurance for closure of these in accordance with 40 CFR Part 265 Subpart H. In order to estimate the amount of financial assurance required, closure cost estimates were prepared for the designated HWMU's at the Refined Metals Corporation facility.

The following sections briefly describe the activities that will be performed to close the HWMU's at the Refined Metals Corporation facility. A short description of each unit, the closure activities that are contemplated for each unit, assumptions used to develop costs for the closure, and the estimated costs for closure are provided in the following sections.

2. HAZARDOUS WASTE MANAGEMENT UNIT DESCRIPTIONS

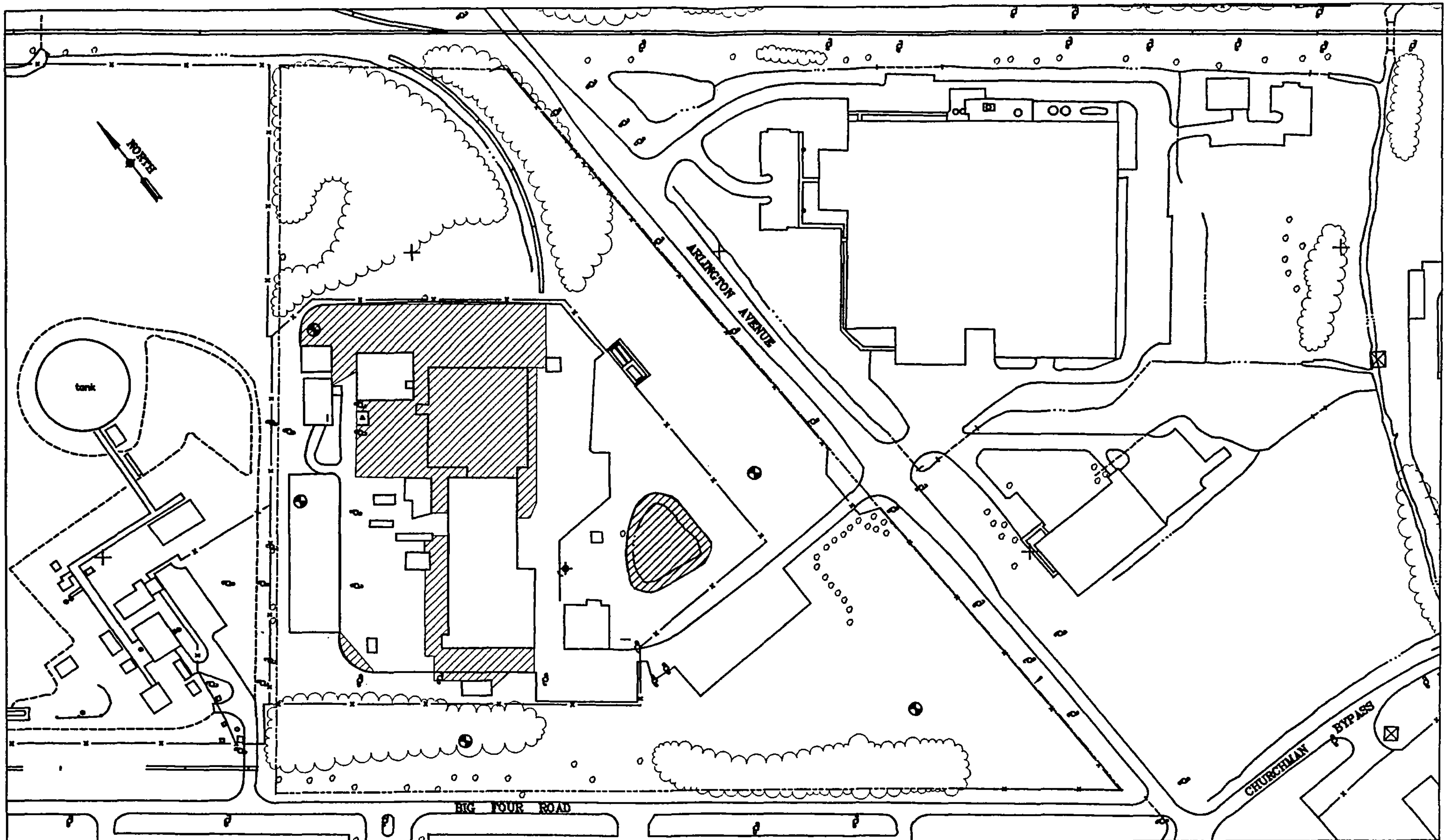
For cost estimating purposes, three types of units have been designated as requiring closure at the Refined Metals Corporation facility. These units have been classified in the proposed Consent Decree as waste piles or as a surface impoundment. Figure 1 is a schematic of the site showing the HWMU's designated for closure at the facility. The following sections describe each of the three types of units.

2.1. Surface Impoundment

The surface impoundment at the facility has an estimated volume of approximately 610,000 gallons. The nominal dimensions of the surface impoundment are 140 feet by 140 feet by approximately five feet deep. Based on available information, the surface impoundment is lined along the sides with a concrete apron approximately four inches thick. The bottom of the impoundment is suspected to be founded on a granular materials or native soils. Overlying the concrete apron and the bottom is a synthetic flexible membrane liner. The surface impoundment is currently used to accumulate storm water runoff from the processing areas of the property. Stormwater accumulated in the impoundment is treated at the facility and discharged under permit to the City of Indianapolis Publicly Owned Treatment Works.

2.2. Inside Waste Piles

Two inside waste piles are located in the building described as the "Materials Storage Building." The Materials Storage Building is approximately 28,700 square



FORMER SOLID WASTE MANAGEMENT UNITS AREAS

MONITOR WELLS (MW-1 THROUGH MW-5)

SCALE: 1" = 100'

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REFINED METALS CORPORATION

HAZARDOUS WASTE MANAGEMENT UNITS SUBJECT TO CLOSURE

SCALE 1" = 100'

K2981290

feet. Equipment present inside the Materials Storage Building include scales, screw conveyors, blast furnaces, and other miscellaneous equipment. The Materials Storage Building is constructed with a concrete floor and concrete load bearing walls up to a height of approximately six feet above floor grade around the entire building except at door openings. The concrete floor is assumed to be approximately six inches thick. Bins, to segregate materials within the Materials Storage Building, are constructed of concrete to heights of approximately six feet above grade. Above the concrete walls, the Materials Storage Building is constructed of corrugated steel siding with steel structural supports. Entrances to the building have been sealed from the outside to mitigate fugitive emissions. When operating, the building was maintained under negative pressure.

Raw material feedstocks were stored in the Materials Storage Building prior to placing the materials in the smelting furnaces. These materials included battery plates and groups, leading bearing materials, baghouse dusts, and other additives to the smelting operation. Slag's and dusts generated from the smelting operations were also accumulated in the Materials Storage Building prior to disposal at third party facilities.

2.3. Outside Waste Piles

Seven Outside Waste Piles have been designated at the facility. The Outside Waste Piles consist of concrete pavement that surrounds the facility. These areas were used for the accumulation of batteries at the facility prior to processing. The concrete surfaces are assumed to be approximately six inches thick. The concrete surfaces drain to several pumping stations which convey stormwater to the wastewater treatment plant or the surface impoundment. The concrete pavement that has been designated as Outside Waste Piles has a total surface area of approximately 125,000 square feet.

3. CLOSURE DESCRIPTIONS AND ASSUMPTIONS

The following sections outline the activities that will be performed to implement closure for the designated HWMU's at the facility. Assumptions used for developing the closure costs are identified to provide a basis for estimated costs. When developing costs for closure it is assumed that clean closure will be achieved for the designated HWMU's and closure as a landfill in accordance with 40 CFR Part 265 Subpart N will not be a requirement. Table 1 summarizes the volumes, types of waste, and requirements for conducting closure used in the closure cost estimates.

3.1. Closure and Corrective Action

The entire facility is subject to the Corrective Action provisions of RCRA. Compliance with Corrective Action is a requirement of the proposed Consent Decree. The HWMU's that will be closed at the facility are subject to a RCRA Facility Investigation, Corrective Measures Studies, and where required Corrective Measures as part of the Corrective Action provisions. In the Consent Decree, it is contemplated that media testing (e.g., soil, sediments, ground water, and air), performed as part of the Corrective Action process, under the Consent Decree will be utilized to demonstrate clean closure at the HWMU's.

Because Corrective Action will be performed at the facility, the closure cost estimates do not include costs for media sampling to demonstrate "clean closure" for the designated HWMU's. It is contemplated that certification of closure by the Owner and a Professional Engineer will consist of physical activities associated with removal or decontamination of the designated structures and documentation of these activities. Certification of Corrective Action for the environmental media will be more appropriately performed during the Corrective Action process.

TABLE 1
ESTIMATED MATERIALS GENERATED FOR CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS
REFINED METALS CORPORATION
BEECH GROVE, INDIANA

DESCRIPTION	TYPE OF MATERIALS	UNITS	UNIT DESCRIPTION	CONVERTED UNITS	CONVERTED UNIT DESCRIPTION	COMMENTS
			Surface Impoundment			
Estimated Volume of Impoundment		610,000	Gallons	None	None	
Volume of Liquids in Impoundment	Characteristically Hazardous < 5% Solids	122,000	Gallons	None	None	20 Percent of Surface Impoundment Volume of 610,000 gallons Treatment in Onsite Wastewater Treatment Unit
Volume of Sludges and Solids	Characteristically Hazardous Solids, Non-Pumpable, Solidified to Pass PFT	18,300	Gallons	163	Tons	3 Percent of Surface Impoundment Volume with 20 percent added to solidfy
Decontamination Liquids - Structures	Liquids < 1% Solids	5,000	Gallons	None	None	Assumes 1.0 Gallon/Square Foot Decontamination Fluids/Treatment in On-site Wastewater Treatment Unit
Decontamination Liquids - Equipment	Liquids < 1 % Solids	500	Gallons	None	None	Treatment in On-site Wastewater Treatment Unit
Liner Materials - Hazardous	Hazardous - Macroencapsulation	5,000	Square Feet	1	20-Cubic Yard	Rolloff Boxes
Liner Materials - Non-Hazardous	Non-Hazardous Subtitle D Waste	15,000	Square Feet	3	20 Cubic Yard	Rolloff Boxes
Four Inch Concrete Apron	Non-Hazardous Construction Debris	6,500	Square Feet	162	Tons	Assumes 150 Pounds/Cubic Foot in place
Concrete Structures in Impoundment	Characteristically Hazardous Waste	500	Square Feet	12	Tons	Assumes 150 Pounds/Cubic Foot in place
0.5 Feet Native Soils Under Concrete Apron	Non-Hazardous Subtitle D Waste	6,500	Square Feet	199	Tons	Assumes 1.1 Swell Factor and 1.5 tons/cubic yard
One Foot Native Soils At Base of Impoundment	Characteristically Hazardous Waste	6,000	Square Feet	367	Tons	Assumes 1.1 Swell Factor and 1.5 tons/cubic yard
			Inside Waste Piles			
Interior Floor Area		28,700	Square Feet			
Interior Ceiling and Wall Areas		46,000	Square Feet			
2 Inches of Dry Residue	Characteristically Hazardous Waste	28,700	Square Feet	479	Tons	Assumes Dust at 200 pounds/cubic foot
Concrete Floor	Characteristically Hazardous Waste	28,700	Square Feet	1,076	Tons	Assumes Concrete at 150 pounds/cubic foot in place
Decontamination Liquids - Structures	Liquids < 1 % Solids	46,000	Square Feet	69,000	Gallons	Assumes Decontamination Liquids at 1.5 Gallons/Square Foot Treatment in On-site Wastewater Treatment Unit
Decontamination Liquids - Equipment	Liquids < 1 % Solids	2,500	Gallons	None	None	Treatment in Onsite Wastewater Treatment Unit
One Foot Native Soil Underlying Floor	Characteristically Hazardous Waste/Listed HazardousWaste	28,700	Cubic Feet	877	Tons	Assumes 1.1 Swell Factor and 1.5 tons/cubic yard

TABLE 1
ESTIMATED MATERIALS GENERATED FOR CLOSURE OF HAZARDOUS WASTE MANAGEMENT UNITS
REFINED METALS CORPORATION
BEECH GROVE, INDIANA

DESCRIPTION	TYPE OF MATERIALS	UNITS	UNIT DESCRIPTION	CONVERTED UNITS	CONVERTED UNIT DESCRIPTION	COMMENTS
Outside Waste Piles						
Total Surface Area of Outside Piles		125,000	Square Feet			
Solids From Sweeping of Concrete Surfaces	Characteristically Hazardous Waste	5	Cubic Yards	8	Tons	
Decontamination Liquids - Structures	Liquids < 1% Solids	112,500	Square Feet	168,750	Gallons	90% of Total Surface Area/Assumes 1.5 Gallons/Square Foot Treatment in Onsite Wastewater Treatment Unit
Decontamination Liquids - Equipment	Liquids < 1 % Solids	1,000	Gallons	None	None	Treatment in Onsite Wastewater Treatment Unit
Concrete Pavement	Non-Hazardous ConstructionDebris	12,500	Square Feet	469	Tons	10% of Total Surface Area/Assumes Concrete at 150 pounds/cubic foot in place
One Foot Native Soil Underlying Floor	50 Percent Characteristically Hazardous	12,500	Cubic Feet	382	Tons	Assumes 1.1 Swell Factor and 1.5 tons/cubic yard

28190/98CH1134_I4/Table1

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3.2. General Assumptions for Closure Activities

Several general assumptions and conditions were used during the development of the activities that will be performed to conduct closure and develop the cost estimates.

1. Closure activities are assumed to commence during a single event.
2. Potable water and power will be available at the facility at no cost during closure activities.
3. Demolition of structures, other than what is described in the following sections, will not be required.
4. Sanitary facilities (e.g., showers, etc.), equipment decontamination structures, and office space will be available at no cost during closure activities.
5. Interior work will be performed in Level C of personal protection. All other work can be performed in Level D of personal protection.
6. All liquid wastes will be treated onsite in the operational wastewater treatment system.
7. Unless otherwise described in following sections it is assumed that the inventory of hazardous waste is zero for the purposes of cost estimating.
8. Media testing will not be required for closure as described in Section 3.1.
9. The baghouse for interior work will be rehabilitated and permitted as a registration unit for remediation activities. Perimeter air monitoring equipment is operational
10. The possibility of recycling or recovering materials for lead or scrap metal value is not considered in the cost estimates.
11. The cost estimate assumes that all work will be performed by a third party.

3.3. Surface Impoundment

The following activities are contemplated to be performed for the surface impoundment:

1. An approved closure plan will be implemented and closure activities will be completed within the 180 day timeframe.
2. Planning documents (health and safety plans, contingency plans, etc.)will be prepared where required by the closure plan
3. Mobilization and demobilization of equipment will be performed. The surface impoundment will be isolated to prevent stormwater from accumulating in the impoundment. It is likely that the surface impoundment will be the last HWMU closed at the facility to mitigate the possibility of alternative stormwater management practices when the impoundment is removed from service.

4. Pumpable liquids in the surface impoundment will be removed from the impoundment using vacuum trucks. The vacuum trucks will transport the liquids onsite tanks for treatment and discharge. For cost estimating purposes it is assumed that the liquids are characteristically hazardous, contain less than five percent solids, and total approximately 20 percent of the impoundment volume.
5. Non-pumpable sludge and plant matter from the impoundment will be removed by mechanical means, loaded into containers, solidified for transportation, and transported for disposal at a third party treatment storage and disposal facility. For cost estimating purposes it is assumed that the solids and debris are characteristically hazardous, do not contain free liquids, and total approximately three percent of the impoundment volume.
6. After removing the inventory, the synthetic flexible membrane liner on the bottom of the impoundment will be decontaminated by pressure washing to remove loose sludge and debris. Decontamination liquids will be generated and pumped into a vacuum truck. It is assumed that decontamination liquids will be managed in the onsite wastewater treatment unit. The surface area to be cleaned on the liner will total approximately 5,000 square feet. Decontamination liquids will be generated at a rate of 1.0 gallon per square foot and will be treated and disposed in the onsite wastewater treatment unit.
7. After decontamination the liner will be cut-up and placed in rolloff boxes for disposal. It is assumed that there is approximately 20,000 square feet of liner material. Seventy five percent of the synthetic liner will not be characteristically hazardous and can be disposed of at a Subtitle D landfill. The remaining 25 percent will be macroencapsulated under the alternative debris standard at 40 CFR Part 268.
8. The concrete apron constructed along the sides of the impoundment and the concrete discharge structure inside the impoundment will be removed with mechanical equipment. The concrete will be placed in steel bed dump trucks and transported to a recycling facility. An estimated 7,000 square feet of 4 inch thick concrete will require removal from the impoundment. It is assumed that the estimated 6,500 square feet of concrete around the sides of the impoundment will not be characteristically hazardous (the synthetic liner covers the concrete sides) and will be disposed as construction debris. The internal concrete structure (500 square feet and 4 inches thick) is assumed to be characteristically hazardous and will be disposed as debris by crushing and stabilization followed by disposal at a Subtitle D facility.
9. After removing the concrete apron, six inches of native soils will be removed from the sides of the impoundment and one foot of soils or granular fill will be removed from approximately 6,000 square feet at the base of the impoundment. Soils will be removed using mechanical equipment and loaded directly into trucks for disposal at the appropriate facility. Soils around the sides of the impoundment are assumed to be non-hazardous and can be disposed in a Subtitle D facility without treatment. Soils at the bottom of the impoundment are assumed to be characteristically hazardous and will be disposed following stabilization in a Subtitle D landfill.
10. During the closure activities, the technical, administrative, and regulatory aspects of the closure will be performed. These activities include conducting waste

characterization, profiling, manifesting, and tracking wastes for disposal, conducting health and safety monitoring, and documenting closure activities.

11. Upon completion of closure activities, a closure report and certifications will be prepared as part of the cost estimate.

3.4. Inside Waste Piles

The following activities are contemplated for the Inside Waste Piles:

1. An approved closure plan will be implemented and closure activities will be completed within the 180 day timeframe.
2. Planning documents (health and safety plans, contingency plans, air monitoring etc.)will be prepared where required by the closure plan.
3. Mobilization and demobilization of equipment will be performed. The baghouse for the Materials Storage Building will be rehabilitated with new bags and an air registration permit secured for operation.
4. Loose residues remaining on the floor of the Materials Storage Building will be vacuumed using a vacuum truck through a sealed rolloff box. These residues will be wetted as they entered the sealed rolloff box to prevent fugitive emissions. For estimating purposes, two (2) inches of dry residues are assumed to be present over 28,700 square feet inside the Materials Storage Building. The dry residues will be shipped offsite for stabilization and disposal at a Subtitle C facility.
5. The concrete floors of the Materials Storage Building will be removed using mechanized equipment. The concrete will be loaded into steel bed dump trucks and transported for crushing, stabilization, and disposal at a Subtitle C facility. It is assumed that 28,700 square feet of 6 inch thick concrete will require removal inside the building.
6. After removing the concrete, the interior of the building (steel siding, concrete walls, steel structural components and ceiling) and remaining equipment will be decontaminated using high pressure, low volume washing equipment. A temporary synthetic liner will be placed on the native soil inside the building to accumulate liquids from the decontamination process. Accumulated liquids will be continuously removed from the liner and pumped into tanker trucks staged at the facility treated in the onsite wastewater treatment unit. It is assumed that the decontamination water will be generated at a rate of 1.5 gallons per square foot. The steel structures and corrugated siding will be cleaned to meet a scrap dealer specification for recycling. Concrete surfaces will be rinsed with a potable water rinse and rinsates will be tested for lead. A clean-up standard will be established in the closure plan for rinsing of the concrete structures.
7. After completing the decontamination process, approximately 1 foot of soil will be removed from the building floor using mechanized equipment. These activities will

involve excavation and loading of dump trucks. The materials will be transported to a facility for stabilization and disposal at a Subtitle C landfill.

8. During the closure activities, the technical, administrative, and regulatory aspects of the closure will be performed. These activities include conducting waste characterizations, profiling, manifesting, and tracking wastes for disposal, conducting health and safety monitoring, sampling water rinsates, and documenting closure activities.
9. Upon completion of closure activities, a closure report and certifications will be prepared.

3.5. Outside Waste Piles

The following activities are contemplated for the Outside Waste Piles that consist of approximately 125,000 square feet of concrete pavement:

1. An approved closure plan will be implemented and closure activities will be completed within the 180 day timeframe.
2. Planning documents (health and safety plans, contingency plans, air monitoring etc.)will be prepared where required by the closure plan.
3. Mobilization and demobilization of equipment will be performed.
4. Loose materials from the concrete surfaces will be vacuumed or swept and placed in containers. An estimated 5 yards of loose materials will be removed during sweeping and vacuuming activities. These materials are assumed to be hazardous waste and will require disposal at a Subtitle C facility. Cracks and expansion joints in the concrete areas to be decontaminated will be sealed with an appropriate sealing compound (e.g., asphaltic road sealer) prior to beginning washing activities.
5. After sweeping and sealing the concrete surfaces, approximately 90 percent (112,500 square feet) of concrete paving will be decontaminated with power washing equipment. Fluids generated during the decontamination process will be transferred to tanks onsite for treatment in the wastewater treatment unit. The volume of water generated will be approximately 1.5 gallons per square foot. A clean-up standard will be established in the closure plan for rinsing of the concrete structures.
6. Degraded concrete that can not be decontaminated will be removed using mechanized equipment. The concrete will be loaded into steel dump trucks and transported to a concrete recycling facility. It is assumed that approximately 10 percent (12,500 square feet) of 6 inch thick concrete paving will require removal.
7. After completing the concrete removal process, approximately 1 foot of soil will be removed from beneath these areas using mechanized equipment. These activities will involve excavation and loading of dump trucks with soil. Fifty percent of the excavated soil is assumed to be characteristically hazardous requiring stabilization

followed by disposal at a Subtitle D facility. It is assumed that the remaining fifty percent of the soil can be disposed at a Subtitle D facility without treatment.

8. During the closure activities, the technical, administrative, and regulatory aspects of the closure will be performed. These activities include conducting waste characterizations, profiling, manifesting, and tracking wastes for disposal, conducting health and safety monitoring, sampling water rinsates, and documenting closure activities.
9. Upon completion of closure activities, a closure report and certifications will be prepared.

4. CLOSURE COST ESTIMATES

Based on the estimated activities that will be required, the assumptions used in the development of costs, and the professional judgment an estimated cost for closure was developed. Table 2 is a summary of the estimated costs to complete closure for each unit. Tables 3, 4, and 5 are detailed cost breakdowns for the surface impoundment, the inside waste piles, and the outside waste piles. For financial assurance, these costs are based on 1998 dollar values.

TABLE 3
ESTIMATED COSTS FOR CLOSURE OF SURFACE IMPOUNDMENT
REFINED METALS CORPORATION
BEECH GROVE, INDIANA

DESCRIPTION	UNITS	AMOUNTS	UNIT COSTS	EXTENDED COSTS
Disposal				
Surface Impoundment Inventory				
Liquids - Hazardous < 5 % Solids	Gallons	122,000	$ 0.10	$ 12,200
Solids - Hazardous	Tons	163	$ 92.00	$ 15,005
Decontamination Liquids - Structures	Gallons	5,000	$ 0.10	$ 500
Decontamination Liquids - Equipment	Gallons	500	$ 0.10	$ 50
Concrete as Debris per 40 CFR Part 268	Tons	12	$ 120.00	$ 1,499
Concrete - Construction Debris	Tons	162	$ 3.50	$ 568
Synthetic Liner - Hazardous - Macroencapsulation	Cubic Yard	20	$ 200.00	$ 4,000
Synthetic Liner - Subtitle D	Cubic Yard	60	$ 25.00	$ 1,500
Soil - Subtitle D	Tons	199	$ 25.00	$ 4,965
Soil - Hazardous	Tons	367	$ 92.00	$ 33,733
Transportation				
Non-Hazardous Liner	Load	4	$ 400.00	$ 1,600
Hazardous Concrete & Liner	Load	2	$ 900.00	$ 1,800
Concrete - Recycle	Load	9	$ 200.00	$ 1,800
Non-Hazardous Soil	Load	10	$ 200.00	$ 2,000
Hazardous Soil	Load	19	$ 233.00	$ 4,427
Labor, Equipment & Supplies				
Mobilization/Demobilization	Days	1	$ 2,000.00	$ 2,000
Decontamination of Equipment	Days	1	$ 2,750.00	$ 2,750
Removal of Inventory in Surface Impoundment	Days	2	$ 1,700.00	$ 3,400
Removal of Synthetic Liner	Days	3	$ 2,960.00	$ 8,880
Removal of Concrete Sides and Structures	Days	5	$ 3,950.00	$ 19,750
Removal of Soil from Sides and Bottom of Impoundment	Days	2	$ 2,960.00	$ 5,920
Project Management/Technical Services	Lump	14	$ 800.00	$ 11,200
Closure Report & Certifications	Lump	1	$ 5,000.00	$ 5,000
Laboratory Analysis				
Waste Determination Samples and Profiling	Lump	1	$ 2,500.00	$ 2,500
Ten Percent Contingency				$ 14,705
Total Estimated Costs for Closure (1998 Dollars)				**$ 161,752**

TABLE 4
ESTIMATED COSTS FOR CLOSURE OF INSIDE WASTE PILE
REFINED METALS CORPORATION
BEECH GROVE, INDIANA

DESCRIPTION	UNITS	AMOUNTS	UNIT COSTS	EXTENDED COSTS
Disposal				
Solid Residues on Floors - Hazardous	Tons	479	$ 92.00	$ 44,095
Decontamination Liquids -Structures	Gallons	69,000	$ 0.10	$ 6,900
Decontamination Liquids - Equipment	Gallons	2,500	$ 0.10	$ 250
Concrete Floor - Hazardous	Tons	1,076	$ 120.00	$ 129,150
Soil - Hazardous	Tons	877	$ 92.00	$ 80,679
Transportation				
Solid Residues	Load	24	$ 433.00	$ 10,392
Concrete - Hazardous	Load	54	$ 750.00	$ 40,500
Soil Hazardous	Load	44	$ 200.00	$ 8,800
Labor, Equipment & Supplies				
Mobilization/Demobilization	Days	1	$ 34,500.00	$ 34,500
Decontamination of Equipment and Personnel	Days	3	$ 2,750.00	$ 8,250
Removal of Residues Inside Building Floor	Days	7	$ 2,750.00	$ 19,731
Removal of Concrete from Building Floor	Days	13	$ 3,950.00	$ 51,350
Decontamination of Interior Structures	Days	8	$ 4,120.00	$ 32,960
Removal of Soil Below Building Floor	Days	4	$ 2,960.00	$ 11,840
Project Management/Technical Services	Lump	36	$ 800.00	$ 28,940
Closure Report & Certifications	Lump	1	$ 3,000.00	$ 3,000
Laboratory Analysis				
Waste Determination Samples and Profiling	Lump	1	$ 2,500.00	$ 2,500
Rinsate Sampling of Walls and Ceilings	Lump	1	$ 1,000.00	$ 1,000
Ten Percent Contingency				$ 51,484
Total Estimated Costs for Closure (1998 Dollars)				**$ 566,321**

TABLE 5
ESTIMATED CLOSURE COSTS FOR OUTSIDE WASTE PILES
REFINED METALS CORPORATION
BEECH GROVE, INDIANA

DESCRIPTION	UNITS	AMOUNTS	UNIT COSTS		EXTENDED COSTS
Disposal					
Solids from Sweeping Concrete Pavement	Tons	8	$	92.00	$690
Decontamination Liquids - Structures	Gallons	168,750	$	0.10	$16,875
Decontamination Liquids - Equipment	Gallons	1,000	$	0.10	$100
Concrete Pavement - Construction Debris	Tons	469	$	3.50	$1,641
Soil - Hazardous	Tons	191	$	92.00	$17,569
Soil - Subtitle D	Tons	191	$	25.00	$4,774
Transportation					
Solids from Sweeping	Load	1	$	233.00	$233
Concrete Pavement	Load	24	$	200.00	$4,800
Soil - Hazardous	Load	5	$	233.00	$1,165
Soil - Subtitle D	Load	5	$	200.00	$1,000
Labor, Equipment & Supplies					
Mobilization/Demobilization	Days	1	$	2,000.00	$2,000
Decontamination of Equipment and Personnel	Days	1	$	2,750.00	$2,750
Sealing of Cracks and Decontamination of Concrete Surfaces	Days	10	$	2,970.00	$29,700
Removal of Concrete Pavement	Days	9	$	3,950.00	$35,550
Removal of Soil Below Concrete	Days	3	$	2,960.00	$8,880
Project Management/Technical Services	Lump	24	$	800.00	$19,200
Closure Report & Certifications	Lump	1	$	3,000.00	$3,000
Laboratory Analysis					
Waste Determination Samples and Profiling	Lump	1	$	1,000.00	$1,000
Rinsate Sampling of Concrete Surfaces	Lump	1	$	1,000.00	$1,000
Ten Percent Contingency					$15,093
Total Estimated Costs for Closure (1998 Dollars)					**$167,020**

APPENDIX E

FINANCIAL INSURANCE/ASSURANCE

EXIDE® CORPORATION

April 24, 1998

Mr. Jeffrey Stevens
Indiana Department of Environmental Management
Hazardous Waste Facilities Branch - IGCN 11th Flr.
100 N. Senate Street
P.O. Box 6015
Indianapolis, IN 46206-6015

RE: Financial Insurance/Assurance
Refined Metals Corporation
Beech Grove, Indiana
EPA Id. No. IND000718130

Dear Mr. Stevens:

In accordance with a Consent Decree signed by Refined Metals Corporation, the Indiana Department of Environmental Management, and the U.S. Environmental Protection Agency, attached is documentation evidencing financial assurance and liability insurance for the subject facility.

Currently, financial assurance for closure was met by an Irrevocable Standby Letter of Credit (LOC) issued by First Tennessee (Documentary Credit Number 28652). The value of the LOC ($37,164) is based on a historic closure cost estimate which has recently been revised. Financial assurance reflecting the revised closure cost estimate ($895,093) is met by a Surety Bond issued by Seaboard Surety Company. A copy of the Surety Bond is attached. With submittal of the Surety Bond, Exide requests IDEM approval to close out the LOC.

Liability insurance is currently met through use of a commercial insurance policy issued by United Coastal Insurance Company (Policy No. HW0507). Exide proposes to replace this insurance policy with the Corporate Guarantee mechanism. Attached is the documentation necessary to demonstrate liability insurance using the Corporate Guarantee. Although General Battery Corporation's latest fiscal year ended on March 31, 1998, the year end audited financials are not yet completed. Therefore, the year end audited financials for the previous fiscal year were used. A revised liability insurance submittal using year end audited financials from the fiscal year which ended March 31, 1998 will be submitted upon completion of these audited financials. With this submittal, Exide requests IDEM approval to cancel the commercial insurance policy.

645 Penn Street Reading, PA 19601
P.O. Box 14205 Reading, PA 19612-4205
610/378-0500
www.exideworld.com/power

To: Mr. Jeffrey Stevens
Page Two

Please feel free to contact me at (610) 378-0874 should you have any questions regarding these submittals.

Very truly yours,

EXIDE CORPORATION

Matthew A. Love
Manager, Regulatory Affairs

MAL:ss

bcc: A. Levine - w/attach.
J. Petrick - w/attach.
R. Steinwurtzel - w/attach.

EXIDE® CORPORATION

April 24, 1998

Commissioner
Indiana Department of Environmental Management
100 N. Senate Street
P.O. Box 6015
Indianapolis, IN 46206-6015

I am the chief financial officer of General Battery Corporation. This letter is in support of the use of the financial test to demonstrate financial responsibility for liability coverage as specified in 329 IAC 3.1-14 or 329 IAC 3.1-15.

The firm identified above is the owner or operator of the following facilities for which liability coverage for sudden accidental occurrences is being demonstrated through the financial test specified in 329 IAC 3.1-14 or 329 IAC 3.1-15.

The firm identified above guarantees, through the guarantee specified in 329 IAC 3.1-14 and 329 IAC 3.1-15, liability coverage for sudden accidental occurrences at the following facilities owned or operated by the following:

EPA I.D. No. IND000718130
Refined Metals Corporation
3700 South Arlington Avenue
Indianapolis, Indiana

The firm identified above is owned by the same parent corporation as the parent corporation of the owner or operator and receiving the following value in consideration of this guarantee: None.

1. The firm identified above owns or operates the following facilities for which financial assurance for closure or post-closure care or liability coverage is demonstrated through the financial test specified in 329 IAC 3.1-14 or 329 IAC 3.1-15. The current closure and/or post-closure cost estimates covered by the test are shown for each facility:

   General Battery Corporation
   2601 West Mt. Pleasant Blvd.
   Muncie, Indiana 47302
   IND000717959
   Closure cost estimate: $3,106,517
   Liability coverage: $1,000,000/occurrence
   $ 2,000,000/annual aggregate

2. The firm identified above guarantees, through the guarantee specified in 329 IAC 3.1-14 or 329 IAC 3.1-15, the closure and post-closure care or liability coverage of the following facilities owned or operated by the guaranteed party. The current cost estimates for the closure or post-closure care so guaranteed are shown for each facility:

   Refined Metals Corporation
   3700 South Arlington Avenue
   Indianapolis, Indiana
   IND000718130
   Liability coverage: $1,000,000/occurrence
   $2,000,000/annual aggregate

3. This firm, as owner or operator or guarantor, is demonstrating financial assurance for the closure or post-closure care of the following facilities through the use of a test specified in 329 IAC 3.1-14 or 329 IAC 3.1-15. The current closure and/or post-closure cost estimates covered by such a test are shown for each facility:

   General Battery Corporation
   2601 West Mt. Pleasant Blvd.
   Muncie, Indiana 47302
   IND000717959
   Closure cost estimate: $3,106,517
   Liability coverage: $1,000,000/occurrence
   $2,000,000/annual aggregate

   Refined Metals Corporation
   3700 South Arlington Avenue
   Indianapolis, Indiana
   IND000718130
   Liability coverage: $1,000,000/occurrence
   $2,000,000/annual aggregate

4. The firm identified above owns or operates the following hazardous waste management facilities for which financial assurance for closure or, if a disposal facility , post-closure care is not demonstrated either to the Environmental Protection Agency (EPA) or a state through the financial test or any other financial assurance mechanism specified in 40 CFR 264 Subpart H and 40 CFR 265 Subpart H, or equivalent or substantially equivalent state mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility: None.

This firm is not required to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this firm ends on March 31st. The figures for the following items marked with an asterisk (*) are derived from this firm's independently audited, year-end financial statements for the latest completed fiscal year, ended March 31, 1997.

Part A. Liability Coverage for Accidental Occurrences

Alternative I

	1.	Amount of annual aggregate liability coverage to be demonstrated.	$ 8,000,000	
*	2.	Current assets.	$ 75,000,000	
*	3.	Current liabilities.	$ 362,000	
	4.	Net working capital (line 2 minus line 3).	$ 74,638,000	
*	5.	Tangible net worth.	$ 80,032,000	
	6.	If less than 90% of assets are located in the U.S., give total U.S. assets.	More than 90% in U.S.	
			YES	**NO**
	7.	Is line 5 at least $10 million?	X	
	8.	Is line 4 at least 6 times line 1?	X	
	9.	Is line 5 at least 6 times line 1?	X	
*	10.	Are at least 90% of assets located in the U.S.? If not, complete line 11.	X	
	11.	Is line 6 at least 6 times line 1?	X	

I hereby certify that the wording of this letter is identical to the wording specified in 329 IAC 3.1-14-32 as such rule was constituted on the date shown immediately below.

Alan E. Gauthier
Chief Financial Officer
April 24, 1998

Guarantee for Liability Coverage

Guarantee made this April 24, 1998 by General Battery Corporation, a business trust organized under the laws of the Commonwealth of Pennsylvania, herein referred to as guarantor. This guarantee is made on behalf of Refined Metals Corporation of 3700 South Arlington Avenue, Indianapolis, Indiana, which is a subsidiary of Exide Corporation, of which guarantor is a subsidiary, to any and all third parties who have sustained or may sustain bodily injury or property damage caused by sudden accidental occurrences arising from operation of the facility(ies) covered by this guarantee.

Recitals

1. Guarantor meets or exceeds the financial test criteria and agrees to comply with the reporting requirements for guarantors as specified in 329 IAC 3.1-15-8(f) and 329 IAC 3.1-14-24(g).

2. Refined Metals Corporation owns or operates the following hazardous waste management facility(ies) covered by this guarantee:

EPA I.D. No. IND000718130
Refined Metals Corporation
3700 South Arlington Avenue
Indianapolis, Indiana

This guarantee satisfies third party liability requirements for hazardous waste under IC 13-7 for sudden accidental occurrences in above-named owner or operator facilities for coverage in the amount $1,000,000 for each occurrence and $2,000,000 annual aggregate.

3. For value received from Refined Metals Corporation, guarantor guarantees to any and all third parties who have sustained or may sustain bodily injury or property damage caused by sudden accidental occurrences arising from operations of the facility(ies) covered by this guarantee that in the event that Refined Metals Corporation fails to satisfy a judgment or award based on a determination of liability for bodily injury or property damage to third parties caused by sudden accidental occurrences, arising from the operation of the above-named facilities, or fails to pay an amount agreed to in settlement of a claim arising from or alleged to arise from such injury or damage, the guarantor will satisfy such judgment(s), award(s), or settlement agreement(s), up to the limits of coverage identified above.

4. Guarantor agrees that if, at the end of any fiscal year before termination of this guarantee, the guarantor fails to meet the financial test criteria, guarantor shall send within ninety (90) days, by certified mail, notice to the commissioner and to Refined Metals Corporation that the guarantor intends to provide alternate liability coverage as specified in 329 IAC 3.1-15-8 and 329 IAC 3.1-14-24, as applicable, in the name of Refined Metals Corporation. Within one hundred twenty (120) days after the end of such fiscal year, the guarantor shall establish such liability coverage unless Refined Metals Corporation has done so.

5. The guarantor agrees to notify the commissioner by certified mail of a voluntary or involuntary bankruptcy proceeding under 11 U.S.C. 101 et seq., October 1, 1979, naming guarantor as debtor, within ten (10) days after commencement of the proceeding.

6. Guarantor agrees that within thirty (30) days after being notified by the commissioner of a determination that guarantor no longer meets the financial criteria or that the guarantor shall establish alternate liability coverage as specified in 329 IAC 3.1-15-8 or 329 IAC 3.1-14-24, in the name of Refined Metals Corporation unless Refined Metals Corporation has done so.

7. Guarantor reserves the right to modify this agreement to take into account amendment or modification of the liability requirements set by 329 IAC 3.1-15-8 and 329 IAC 3.1-14-24, provided that such modification shall become effective only if the commissioner does not disapprove the modification within thirty (30) days of receipt of notification of the modification.

8. Guarantor agrees to remain bound under this guarantee for so long as Refined Metals Corporation must comply with the applicable requirements of 329 IAC 3.1-15-8 and 329 IAC 3.1-14-24 for the above-listed facility(ies), except as provided in paragraph 9 of this agreement.

9. Guarantor may terminate this guarantee by sending notice by certified mail to the commissioner and to Refined Metals Corporation, provided that this guarantee may not be terminated unless and until Refined Metals Corporation obtains, and the commissioner approves alternate liability coverage complying with 329 IAC 3.1-15-8 and/or 329 IAC 3.1-14-24.

10. Guarantor hereby expressly waives notice of acceptance of this guarantee by any party.

11. Guarantor agrees that this guarantee is in addition to and does not affect any other responsibility or liability of the guarantor with respect to the covered facilities.

12. Guarantor shall satisfy a third party liability claim only on receipt of one (1) of the following documents, either (a) or (b):

(a) Certification from the principal and the third party claimant or claimants that the liability claim must be paid. The certification must be worded as follows except that instructions in brackets are to be replaced with the relevant information and the brackets deleted:

Certification of Valid Claim

The undersigned, as parties [insert principal] and [insert name and address of third party claimant or claimants], hereby certify that the claim of bodily injury, property damage, or bodily injury and property damage caused by a [sudden or nonsudden] accidental occurrence arising from operating [principal's hazardous waste treatment, storage, or disposal facility] must be paid in the amount of $___.

[Signature]

Principal _____

(Notary) Date ____

[Signature or signatures]

Claimant or claimants ___

(Notary) Date ____

(b) A valid final court order establishing a judgment against the principal for bodily injury or property damage caused by sudden or nonsudden accidental occurrences arising from the operation of the principal's facility or group of facilities.

13. In the event of the combination of this guarantee with another mechanism to meet liability requirements, this guarantee will be considered excess coverage.

(b) Such obligation does not apply to any of the following:

(1) Bodily injury or property damage for which Refined Metals Corporation is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages that Refined Metals Corporation would be obligated to pay in the absence of the contract or agreement.

(2) Any obligation of Refined Metals Corporation under a workers' compensation, disability benefits, or unemployment compensation law or any similar law.

(3) Bodily injury to:

(A) an employee of Refined Metals Corporation arising from, and in the course of, employment by Refined Metals Corporation; or

(B) the spouse, child, parent, brother, or sister of that employee as a consequence of, or arising from, and in the course of, employment by Refined Metals Corporation.

(4) Subdivision (3) applies:

(A) whether Refined Metals Corporation may be liable as an employer or in any other capacity; and

(B) to any obligation to share damages with or repay another person who must pay damages because of the injury to persons identified in subdivision (3).

(5) Bodily injury or property damage arising out of the ownership, maintenance, use, or entrustment to others of any aircraft, motor vehicle, or watercraft.

(6) Property damage to any of the following:

(A) Any property owned, rented, or occupied by Refined Metals Corporation.

(B) Premises that are sold, given away, or abandoned by Refined Metals Corporation if the property damage arises out of any part of those premises.

(C) Property loaned to Refined Metals Corporation.

(D) Personal property in the care, custody, or control of Refined Metals Corporation.

(E) That particular part of real property on which Refined Metals Corporation or any contractors or subcontractors working directly or indirectly on behalf of Refined Metals Corporation are performing operations, if the property damage arises out of these operations.

I hereby certify that the wording of this guarantee is identical to the wording specified in 329 IAC 3.1-14-34 as such rule was constituted on the date shown immediately below.

Effective date: April 24, 1998

General Battery Corporation

Alan E. Gauthier
Chief Financial Officer

Signature of witness or notary:

Notarial Seal
Debra L. St... Notary Public
Reading ...
My Commission ... 30, 1999
... Notaries

ARTHUR ANDERSEN LLP

INDEPENDENT PUBLIC ACCOUNTANTS' REPORT ON APPLYING AGREED-UPON PROCEDURES

To General Battery Corporation:

We have audited, in accordance with generally accepted auditing standards, the consolidated financial statements of General Battery Corporation and subsidiary ("the Company") for the fiscal year ended March 31, 1997, and have issued our report thereon dated June 24, 1997. We have not performed any auditing procedures since that date.

We have performed the procedures enumerated below solely to assist you with respect to demonstrating compliance with the financial test for liability coverage and closure care of the Indiana Department of Environmental Management. This engagement to apply agreed-upon procedures was performed in accordance with standards established by the American Institute of Certified Public Accountants. The sufficiency of the procedures is solely the responsibility of the specified users of the report. Consequently, we make no representation regarding the sufficiency of the procedures described below either for the purpose for which this report has been requested or for any other purpose.

We have read the letter dated April 24, 1998, from the Chief Financial Officer of the Company to the Indiana Department of Environmental Management and compared the data set forth in: Line 2 (current assets) Line 3 (current liabilities), Line 4 (net working capital - Line 2 minus Line 3) and Line 5 (tangible net worth), to the audited consolidated financial statements from which such information is derived noting agreement.

With respect to Lines 6 and 10 (total assets in the United States), we also verified that, as of March 31, 1997, greater than 90% of the Company's total assets were located in the United States.

We were not engaged to perform an audit, the objective of which would be the expression of an opinion on the Company's consolidated financial statements or specified elements, accounts, or items thereof. Accordingly, we do not express such an opinion. Had we been engaged to perform additional procedures, other matters might have come to our attention that would have been reported to you.

Further, reference is made to Notes 3 and 4 of the Company's fiscal 1997 audited consolidated financial statements (attached as Exhibit 1) which discuss that the Company's parent, Exide Corporation, has indemnified the Company for all existing environmental-related matters.

This report is intended solely for the use of the Company and should not be used by those who have not agreed to the procedures and taken responsibility for the sufficiency of the procedures for their purposes.

Arthur Andersen LLP

Philadelphia, Pa.,
April 28, 1998

ARTHUR ANDERSEN LLP

REPORT OF INDEPENDENT PUBLIC ACCOUNTANTS

To the Shareholder of
General Battery Corporation:

We have audited the accompanying consolidated balance sheets of General Battery Corporation (a Pennsylvania business trust and a wholly owned subsidiary of Exide Corporation) and subsidiary as of March 31, 1997 and 1996, and the related consolidated statements of income and retained earnings and cash flows for the years then ended. These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on these financial statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of General Battery Corporation and subsidiary as of March 31, 1997 and 1996, and the results of their operations and their cash flows for each of the years then ended in conformity with generally accepted accounting principles.

This report is furnished solely for the use of General Battery Corporation in connection with its capital lease and financial assurance obligations and should not be used for any other purpose.

Arthur Andersen LLP

Philadelphia, Pa.,
June 24, 1997

GENERAL BATTERY CORPORATION AND SUBSIDIARY

CONSOLIDATED BALANCE SHEETS

(In thousands, except unit data)

ASSETS	March 31 1997	March 31 1996
CURRENT ASSETS:		
Inventories (Note 1)	$ 75,000	$ 75,000
PROPERTY, PLANT AND EQUIPMENT, at cost (Notes 1 and 2):		
Land and land improvements	2,390	2,419
Buildings and improvements	26,231	28,266
Machinery and equipment	63,725	84,528
	92,346	115,213
Less- Accumulated depreciation	(85,467)	(106,781)
Net property, plant and equipment	6,879	8,432
GOODWILL, net (Note 1)	19,270	20,495
	$ 101,149	$ 103,927

LIABILITIES AND SHAREHOLDER'S EQUITY	March 31 1997	March 31 1996
CURRENT LIABILITIES:		
Current maturities of capital lease obligations (Note 2)	$ 349	$ 621
Accrued interest	13	17
Total current liabilities	362	638
CAPITAL LEASE OBLIGATIONS (Note 2)	1,485	1,834
COMMITMENTS AND CONTINGENCIES (Notes 3 and 4)		
SHAREHOLDER'S EQUITY (Notes 1 and 4):		
Common stock, no par value; 10 beneficial units issued and outstanding	—	—
Additional paid-in capital	100,128	100,128
Retained earnings	79,465	80,922
Less- Due from parent company	(80,291)	(79,595)
Total shareholder's equity	99,302	101,455
	$ 101,149	$ 103,927

The accompanying notes are an integral part of these statements.

GENERAL BATTERY CORPORATION AND SUBSIDIARY

CONSOLIDATED STATEMENTS OF INCOME AND RETAINED EARNINGS

(In thousands)

	For the Year Ended March 31	
	1997	1996
REVENUES:		
Leasing revenues (Note 1)	$ 8,030	$ 9,016
EXPENSES:		
Leasing costs	1,930	2,086
Interest expense	6,472	6,511
Goodwill amortization	1,225	1,225
Total expenses	9,627	9,822
Loss before income taxes	(1,597)	(806)
INCOME TAXES (Note 1)	(140)	156
Net loss	(1,457)	(962)
RETAINED EARNINGS, BEGINNING OF YEAR	80,922	81,884
RETAINED EARNINGS, END OF YEAR	$ 79,465	$ 80,922

The accompanying notes are an integral part of these statements.

GENERAL BATTERY CORPORATION AND SUBSIDIARY

CONSOLIDATED STATEMENTS OF CASH FLOWS (NOTE 1)

(In thousands)

	For the Year Ended March 31	
	1997	1996
CASH FLOWS FROM OPERATING ACTIVITIES:		
Net loss	$ (1,457)	$ (962)
Adjustments to reconcile net loss to net cash provided by (used in) operating activities-		
Depreciation and amortization	2,545	2,991
Decrease in accounts receivable	—	69,000
Increase in inventory	—	(75,000)
Decrease in accrued interest	(4)	(3)
Net book value of property, plant and equipment retirements, transfers and dispositions	233	—
Net cash provided by (used in) operating activities	1,317	(3,974)
CASH FLOWS FROM FINANCING ACTIVITIES:		
Principal payments under capital lease obligations	(621)	(296)
(Increase) decrease in due from parent	(696)	4,270
Net cash (used in) provided by financing activities	(1,317)	3,974
NET CHANGE IN CASH AND CASH EQUIVALENTS	—	—
CASH AND CASH EQUIVALENTS, BEGINNING OF YEAR	—	—
CASH AND CASH EQUIVALENTS, END OF YEAR	$ —	$ —

The accompanying notes are an integral part of these statements.

GENERAL BATTERY CORPORATION AND SUBSIDIARY

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES:

Principles of Consolidation and Nature of Operations

On October 1, 1993, General Battery Corporation, a corporation organized and operating under the laws of the State of Delaware, was merged with and into GBC NEWCO (the "Company"), a corporation organized and operating under the laws of the Commonwealth of Pennsylvania as a Pennsylvania Business Trust. Subsequently, the Company was renamed General Battery Corporation, and exists and operates as a Pennsylvania Business Trust.

On May 27, 1987, the Company was acquired by Exide Corporation (the "Parent"). Effective February 1, 1988, the Company transferred to the Parent all of its assets and liabilities except certain property, plant and equipment; goodwill; and its capital lease obligations, and the Parent assumed substantially all of the operations of the Company and its subsidiary. In connection with this transaction, the Company entered into a Facilities Lease Agreement and a Facilities Services Agreement with the Parent on a net lease basis. These agreements provide that the Company will lease its remaining property, plant and equipment to, and will perform various support services for, the Parent. The Facilities Lease Agreement has been amended annually to adjust the annual lease amount to market rates since January 1994.

The accompanying consolidated financial statements include the accounts of the Company and its wholly owned subsidiary. All material intercompany accounts and transactions have been eliminated.

Inventory

During fiscal 1997 and 1996, the Company was a party to an Inventory Sale Agreement with the Parent whereby the Company purchased from the Parent certain finished goods inventory, subject to security interests granted by the Parent to its lenders. Consideration for this was a reduction of the Company's Due From Parent balance at 100% of the face value of the inventory sold. The Company was allocated $6,285,000 of interest expense from the Parent in fiscal 1997 and 1996.

FINANCIAL GUARANTEE BOND

Date Bond Executed: April 23, 1998

Effective Date: April 23, 1998

Type of Organization: Corporation

State of Incorporation: Delaware

Surety Name and Address: Seaboard Surety Company, 601 W. Germantown Pike, Suite 250, Plymouth Meeting, PA 19462

EPA Identification Number: IND000718130

Name and Address of Principal: Refined Metals Corporation, c/o Smith Consulting, 444 Penn St., Reading, PA [illegible]

Facility Name and Address: Refined Metals Facility, 3700 South Arlington Avenue, Beech Grove, Indiana

Closure/Post-Closure Amount: $891,091.00

Total Penal Sum of Bond: $891,091.00

Surety's Bond Number: [illegible]

KNOW ALL PERSONS BY THESE PRESENTS, That we, the Principal and Surety hereto are firmly bound to the Indiana Department of Environmental Management in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally, firmly by these presents.

WHEREAS said Principal is required, under IC 13-[illegible] and 329 IAC 3.1, to have a permit or interim status in order to own or operate each hazardous waste management facility identified above, and

WHEREAS, said Principal is required to provide financial assurance for closure, or closure and post-closure care, as a condition of the permit or interim status, and

WHEREAS said Principal shall establish a standby trust fund as is required when a surety bond is used to provide such financial assurance;

NOW, THEREFORE, THE CONDITIONS OF THE OBLIGATION ARE SUCH that if the Principal shall faithfully, before the beginning of final closure of each facility identified above, fund the standby trust fund in the amount identified above for the facility, or if the Principal shall fund the standby trust fund in such amount within fifteen (15) days after a final order to begin closure is issued by the Indiana Department of Environmental Management or a U.S. district court or other court of competent jurisdiction, or if the Principal shall provide alternate financial assurance as specified in 329 IAC 3.1-14, as applicable, and obtain the commissioner's written approval of such assurance, within ninety (90) days after the date notice of cancellation is received by both the Principal and the commissioner from the Surety, then this obligation shall be null and void; otherwise it is to remain in full force and effect.

FINANCIAL GUARANTEE BOND

Date Bond Executed: April 23. 1998

Effective Date: April 23. 1998

Type of Organization: Corporation

State of Incorporation: Delaware

Surety Name and Address: Seaboard Surety Company
600 W. Germantown Pike. Suite 260. Plymouth Meeting. PA 19462

EPI Identification Number: IND000718130

Name and Address of Principal: Refined Metals Corporation
c/o Exide Corporation. 645 Penn St.. Reading. PA 19601

Facility Name and Address: Refined Metals Facility
3700 South Arlington Avenue. Beech Grove. Indiana

Closure/Post-Closure Amount: $895.093.00

Total Penal Sum of Bond: $895.093.00

Surety's Bond Number: 323777

KNOW ALL PERSONS BY THESE PRESENTS, That we, the Principal and Surety hereto are firmly bound to the Indiana Department of Environmental Management in the above penal sum for the payment of which we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally, firmly by these presents.

WHEREAS said Principal is required. under IC 13-7 and 329 IAC 3.1, to have a permit or interim status in order to own or operate each hazardous waste management facility identified above, and

WHEREAS, said Principal is required to provide financial assurance for closure, or closure and post-closure care, as a condition of the permit or interim status, and

WHEREAS said Principal shall establish a standby trust fund as is required when a surety bond is used to provide such financial assurance;

NOW, THEREFORE . THE CONDITIONS OF THE OBLIGATION ARE SUCH that if the Principal shall faithfully before the beginning of final closure of each facility identified above. fund the standby trust fund in the amount identified above for the facility. or. if the Principal shall fund the standby trust fund in such amount within fifteen (15) days after a final order to begin closure is issued by the Indiana Department of Environmental Management or a U.S. district court or other court of competent jurisdiction. or, if the Principal shall provide alternate financial assurance. as specified in 329 IAC 3.1-14. as applicable. and obtain the commissioner's written approval of such assurance. within ninety (90) days after the date notice of cancellation is received by both the Principal and the commissioner from the Surety, then this obligation shall be null and void. otherwise it is to remain in full force and effect.

The Surety shall become liable on this bond obligation only when the Principal has failed to fulfill the conditions described above. Upon notification by the commissioner that the Principal has failed to perform as guaranteed by this bond, the Surety shall place funds in the amount guaranteed for the facility into the standby trust fund as directed by the commissioner. The liability of the Surety shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond, but in no event shall the obligation of the Surety hereunder exceed the amount of said penal sum.

The Surety may cancel the bond by sending notice of cancellation by certified mail to the Principal and to the commissioner, provided, however, that cancellation shall not occur during the one hundred twenty (120) days beginning on the date of receipt of the notice of cancellation by both the Principal and the commissioner, as evidenced by the return receipts. The Principal may terminate this bond by sending written notice to the Surety, provided, however, that no such notice shall become effective until the Surety receives written authorization for termination of the bond by the commissioner.

Principal: Refined Metals Corporation

By: ______________________

Surety: Seaboard Surety Company

By: ______________________

Pamela L. Nunez, Attorney-in-Fact

The Surety shall become liable on this bond obligation only when the Principal has failed to fulfill the conditions described above. Upon notification by the commissioner that the Principal has failed to perform as guaranteed by this bond, the Surety shall place funds in the amount guaranteed for the facility into the standby trust fund as directed by the commissioner. The liability of the Surety shall not be discharged by any payment or succession of payments hereunder, unless and until such payment or payments shall amount in the aggregate to the penal sum of the bond, but in no event shall the obligation of the Surety hereunder exced the amount of said penal sum.

The Surety may cancel the bond by sending notice of cancellation by certified mail to the Principal and to the commissioner, provided, however, that cancellation shall not occur during the one hundred twenty (120) days beginning on the date of receipt of the notice of cancellation by both the Principal and the commissioner, as evidenced by the return receipts. The Principal may terminate this bond by sending written notice to the Surety, provided, however, that no such notice shall become effective until the Surety receives written authorization for termination of the bond by the commissioner.

Principal: Refined Metals Corporation

By: Steph J. Morton

Surety: Seaboard Surety Company

By: Pamela L. Nunez

Pamela L. Nunez, Attorney-in-Fact

0700 -95

Filed Copy

SEABOARD SURETY COMPANY

ADMINISTRATIVE OFFICES, BEDMINSTER, NEW JERSEY

POWER OF ATTORNEY

No. 15450

KNOW ALL MEN BY THESE PRESENTS: That SEABOARD SURETY COMPANY, a corporation of the State of New York, has made, constituted and appointed and by these presents does make, constitute and appoint Karen L. Jensen or Nancy M. Rumold or Christine A. Hartung or Leslie [illegible] Thieda or Pamela L. Nunez or Elena [illegible] or James L. Ely

of Pittsburgh, Pennsylvania

its true and lawful Attorney-in-Fact, to make, execute and deliver on its behalf insurance policies, surety bonds, undertakings and other instruments of similar nature as follows:

Without Limitations

Such insurance policies, surety bonds, undertakings and instruments for said purposes, when duly executed by the aforesaid Attorney-in-Fact, shall be binding upon the said Company as fully and to the same extent as if signed by the duly authorized officers of the Company and sealed with its corporate seal; and all the acts of said Attorney-in-Fact, pursuant to the authority hereby given, are hereby ratified and confirmed.

This instrument is made pursuant to the following By-Laws which were duly adopted by the Board of Directors of the said Company on December [illegible], 1927, with Amendments to and including January 15, 1982 and are still in full force and effect:

ARTICLE VII, SECTION 1:

[illegible]

IN WITNESS WHEREOF, SEABOARD SURETY COMPANY has caused these presents to be signed by one of its Vice-Presidents, and its corporate seal to be hereunto affixed and duly attested by one of its Assistant Secretaries, this 29th day of January, 19 93.

SEABOARD SURETY COMPANY

Attest:

By [signature]

Vice-President

Assistant Secretary

STATE OF NEW JERSEY

COUNTY OF SOMERSET

On this [illegible] day of January, 19 93, before me personally appeared [illegible], a Vice-President of SEABOARD SURETY COMPANY, with whom I am personally acquainted, who, being by me duly sworn, said that he resides in the State of New Jersey; that he is a Vice-President of SEABOARD SURETY COMPANY, the corporation described in and which executed the foregoing instrument; that he knows the corporate seal of the said Company; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said Company; and that he signed his name thereto as Vice-President of said Company by like authority.

[illegible]

Notary Public

My Commission Expires Sept. 5, 1998

CERTIFICATE

I, the undersigned Assistant Secretary of SEABOARD SURETY COMPANY do hereby certify that the original Power of Attorney of which the foregoing is a full, true and correct copy, is in full force and effect on the date of this Certificate and I do further certify that the Vice-President who executed the said Power of Attorney was one of the Officers authorized by the Board of Directors to appoint an attorney-in-fact as provided in Article VII, Section 1, of the By-Laws of SEABOARD SURETY COMPANY.

This Certificate may be signed and sealed by facsimile under and by authority of the following resolution of the Executive Committee of the Board of Directors of SEABOARD SURETY COMPANY at a meeting duly called and held on the 25th day of March 1970.

"RESOLVED: (2) That the use of a printed facsimile of the corporate seal of the Company and of the signature of an Assistant Secretary on any certification of the correctness of a copy of an instrument executed by the President or a Vice-President pursuant to Article VII, Section 1, of the By-Laws appointing and authorizing an attorney-in-fact to sign in the name and on behalf of the Company surety bonds, underwriting undertakings or other instruments described in said Article VII, Section 1, with like effect as if such seal and such signature had been manually affixed and made, hereby is authorized and approved."

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the corporate seal of the Company to these presents this [illegible] day of April, 19 95.

Assistant Secretary

Form 287 (Rev. 7/84)

Certified Copy

No. 15450

SEABOARD SURETY COMPANY

3F- 0070

ADMINISTRATIVE OFFICES, BEDMINSTER, NEW JERSEY

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That SEABOARD SURETY COMPANY, a corporation of the State of New York, has made, constituted and appointed and by these presents does make, constitute and appoint Karen L. Jensen or Nancy M. Kunold or Christine A. Hartung or Leslie L. Rudat or Pamela L. Nunez or Elena Zunic or James L. Bly

of Pittsburgh, Pennsylvania

its true and lawful Attorney-in-Fact, to make, execute and deliver on its behalf insurance policies, surety bonds, undertakings and other instruments of similar nature as follows:

Without Limitations

Such insurance policies, surety bonds, undertakings and instruments for said purposes, when duly executed by the aforesaid Attorney-in-Fact, shall be binding upon the said Company as fully and to the same extent as if signed by the duly authorized officers of the Company and sealed with its corporate seal; and all the acts of said Attorney-in-Fact, pursuant to the authority hereby given, are hereby ratified and confirmed.

This appointment is made pursuant to the following By-Laws which were duly adopted by the Board of Directors of the said Company on December 8th, 1927, with Amendments to and including January 15, 1982 and are still in full force and effect:

ARTICLE VII, SECTION 1:

"Policies, bonds, recognizances, stipulations, consents of surety, underwriting undertakings and instruments relating thereto.

Insurance policies, bonds, recognizances, stipulations, consents of surety and underwriting undertakings of the Company, and releases, agreements and other writings relating in any way thereto or to any claim or loss thereunder, shall be signed in the name and on behalf of the Company

(a) by the Chairman of the Board, the President, a Vice-President or a Resident Vice-President and by the Secretary, an Assistant Secretary, a Resident Secretary or a Resident Assistant Secretary; or (b) by an Attorney-in-Fact for the Company appointed and authorized by the Chairman of the Board, the President or a Vice-President to make such signature; or (c) by such other officers or representatives as the Board may from time to time determine.

The seal of the Company shall if appropriate be affixed thereto by any such officer, Attorney-in-Fact or representative."

IN WITNESS WHEREOF, SEABOARD SURETY COMPANY has caused these presents to be signed by one of its Vice-Presidents, and its corporate seal to be hereunto affixed and duly attested by one of its Assistant Secretaries, this 29th day of January, 19 98

SEABOARD SURETY COMPANY 1927 STATE OF NEW YORK

Attest:

(Seal) Assistant Secretary

SEABOARD SURETY COMPANY,

By Brian P. Curry

Brian P. Curry Vice-President

STATE OF NEW JERSEY
COUNTY OF SOMERSET ss.:

On this 29th day of January, 19 98, before me personally appeared Brian P. Curry a Vice-President of SEABOARD SURETY COMPANY, with whom I am personally acquainted, who, being by me duly sworn, said that he resides in the State of New Jersey; that he is a Vice-President of SEABOARD SURETY COMPANY, the corporation described in and which executed the foregoing instrument; that he knows the corporate seal of the said Company; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said Company; and that he signed his name thereto as Vice-President of said Company by like authority.

(Seal) BELINDA FAYE LEE NOTARY PUBLIC STATE OF NEW JERSEY

BELINDA FAYE LEE
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Sept. 9,1998

Belinda Faye Lee

Notary Public

CERTIFICATE

I, the undersigned Assistant Secretary of SEABOARD SURETY COMPANY do hereby certify that the original Power of Attorney of which the foregoing is a full, true and correct copy, is in full force and effect on the date of this Certificate and I do further certify that the Vice-President who executed the said Power of Attorney was one of the Officers authorized by the Board of Directors to appoint an attorney-in-fact as provided in Article VII, Section 1, of the By-Laws of SEABOARD SURETY COMPANY.

This Certificate may be signed and sealed by facsimile under and by authority of the following resolution of the Executive Committee of the Board of Directors of SEABOARD SURETY COMPANY at a meeting duly called and held on the 25th day of March 1970.

"RESOLVED: (2) That the use of a printed facsimile of the corporate seal of the Company and of the signature of an Assistant Secretary on any certification of the correctness of a copy of an instrument executed by the President or a Vice-President pursuant to Article VII, Section 1, of the By-Laws appointing and authorizing an attorney-in-fact to sign in the name and on behalf of the Company surety bonds, underwriting undertakings or other instruments described in said Article VII, Section 1, with like effect as if such seal and such signature had been manually affixed and made, hereby is authorized and approved."

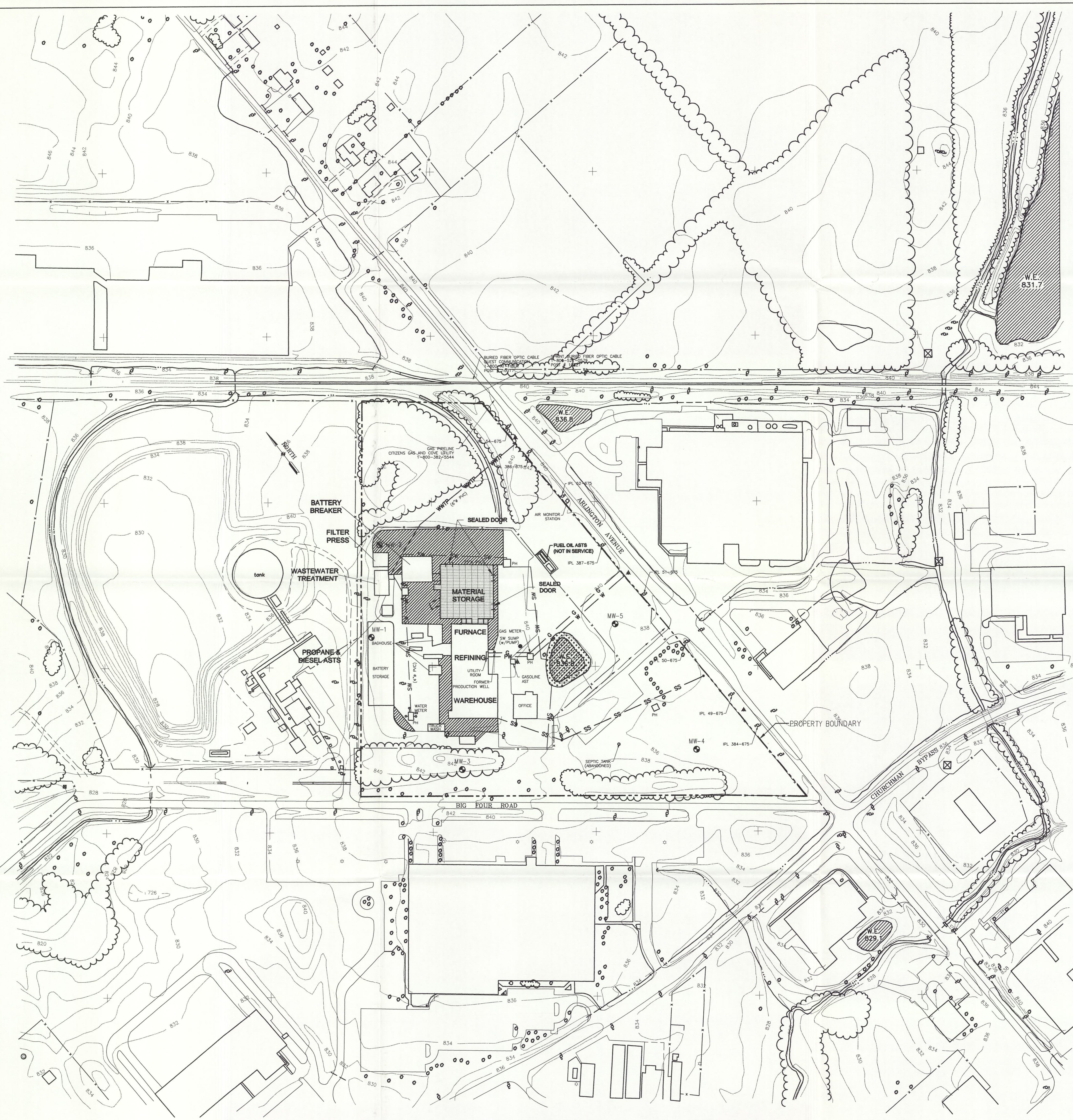
IN WITNESS WHEREOF, I have hereunto set my hand and affixed the corporate seal of the Company to these presents this 23rd day of April, 19 98

SEABOARD SURETY COMPANY 1927 STATE OF NEW YORK

Mary E. Slawicki

Assistant Secretary

Form 957 (Rev 7/84)



LEGEND

- FORMER IMPOUNDMENT OVERFLOW DITCH
- G — GAS
- SS — SANITARY SEWER
- SW — STORMWATER SEWER
- WWTP — 6" PVC WASTE WATER TREATMENT LINE
- PW — POND WATER LINE
- FIRE HYDRANT
- LIGHT POLE
- MONITORING WELL
- PH — PUMP HOUSE
- STORMWATER NLET

REGULATED UNITS

- OUTDOOR WASTE PILES
- INDOOR WASTE PLES
- LINED LAGOON

NOTE: UTILITY LOCATIONS ARE APPROXIMATE BASED ON FIELD VISIT BY AGC. LOCATIONS HAVE NOT BEEN SURVEYED.

150 0 150 300
SCALE IN FEET

REFINED METALS CORPORATION CLOSURE PLAN

BEECH GROVE, INDIANA

Date:	10/12/98
Scale:	1'=150'
Drawn By:	P.S.G.
Checked By:	S.W.K.
Project Mgr.:	P.G.S.
Project No.:	98-478-02
Dwg No.	98478-04
Issued:	OCT 12 1998

EXISTING CONDITIONS

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

FIGURE: 1-2

J:\REFINED METALS\DEAWINGS\9847802\98478-04